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REPORT OF SURVEY CONDUCTED AT

**MASON & HANGER CORPORATION
PANTEX PLANT**

AMARILLO, TX

MAY 1996

Best Manufacturing Practices

**BEST MANUFACTURING PRACTICES CENTER OF EXCELLENCE
College Park, Maryland**

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Foreword



This report was produced by the Best Manufacturing Practices (BMP) program, a unique industry and government cooperative technology transfer effort that improves the competitiveness of America's industrial base both here and abroad. Our main goal at BMP is to increase the quality, reliability, and maintainability of goods produced by American firms. The primary objective towards this goal is simple: to identify best practices, document them, and then encourage industry and government to share information about them.

The BMP program set out in 1985 to help businesses by identifying, researching, and promoting exceptional manufacturing practices, methods, and procedures in design, test, production, facilities, logistics, and management – all areas highlighted in the Department of Defense's 4245-7.M, *Transition from Development to Production* manual. By fostering the sharing of information across industry lines, BMP has become a resource in helping companies identify their weak areas and examine how other companies have improved similar situations. This sharing of ideas allows companies to avoid costly and time-consuming duplication of what others have already tried and learned from.

BMP identifies and documents best practices by conducting in-depth, voluntary surveys such as this one at the Mason & Hanger Corporation's Pantex plant conducted during the week of May 20, 1996. Teams of BMP experts work hand-in-hand on-site with the company to examine existing practices, uncover best practices, and identify areas for even better practices.

The final survey report, which details the findings, is distributed electronically and in hard copy to thousands of representatives from government, industry, and academia throughout the U.S. and Canada – *so the knowledge can be shared*. BMP also distributes this information through several interactive services which include CD-ROMs, BMPnet, and a World Wide Web HomePage located on the Internet at <http://www.bmpcoe.org>. The actual exchange of detailed data is between companies at their discretion.

The BMP program has seen the effect of the world political climate on many Department of Energy sites, and this was echoed at Pantex. Downsizing and reorganization of many of these former weapons sites have influenced their objectives, and the previously-controlled aspects of their operations are giving way to consolidation of capabilities and more contact with the general public. The need for segregated pockets of personnel and processes, development of advanced technology and manufacturing processes restricted from public distribution, and limited benchmarking outside the confines of the installation were common attributes of these DOE facilities. Mason & Hanger - Pantex has successfully modified these characteristics into many of the best practices in this report.

The Best Manufacturing Practices program is committed to strengthening the U.S. industrial base. Survey findings in reports such as this one on Mason & Hanger - Pantex expand BMP's contribution toward its goal of a stronger, more competitive, globally-minded, and environmentally-conscious American industrial program.

I encourage your participation and use of this unique resource.

A handwritten signature in cursive script, reading 'Ernie Renner'.

Ernie Renner

Director, Best Manufacturing Practices

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Section 1

Report Summary

Background

The Mason & Hanger Corporation (M&H) is the management and operating contractor at the Department of Energy (DOE) Pantex plant located outside of Amarillo, TX. This DOE facility covers more than 16,000 acres, and Mason & Hanger is responsible for more than 3,000 employees. With an additional staff of 600 from various government agencies and contractors such as Battelle Memorial Institute and Sandia National Laboratories, Pantex is the only facility tasked with the assembly, disassembly, repair, and retirement of the nation's nuclear weapons. Although originally constructed during World War II as a conventional bomb construction plant, Pantex as evolved into a facility with five primary operational missions including: to fabricate chemical high explosive components for nuclear weapons; to assemble nuclear weapons for the nation's stockpile; to maintain and evaluate the nuclear weapons in the stockpile; to disassemble nuclear weapons from the stockpile; and, to serve as an interim storage site for plutonium components from retired weapons.

Security and safety are critical issues to Pantex employees because of the nature of the nuclear assembly/disassembly processes. Relating closely to these issues are the environmental and human health and safety concerns for on-site personnel and the surrounding population. The plant has highly-developed and sophisticated security and environmental elements that work intently with the government agencies to ensure total control of the processes from cradle to grave. These elements include a 550-person Security Force, as well as Environmental Safety & Health, Waste Management, Environmental Restoration activities.

A recurring theme at Department of Energy sites that the Best Manufacturing Practices (BMP) program has seen since the early 1990s has been the effect of the world political climate on these installations -- a situation echoed at Pantex. Downsizing and reorganization of many of these former weapons design and production sites have influenced these sites' objectives to include consolidation of capabilities, and to initiate contact with the general public to keep them informed and provide opportunities for input. The need for segregated pockets of personnel and processes, development of advanced technology and manufacturing processes restricted from public distribution, and limited benchmarking outside the confines of the installation were common attributes of these sites. Mason &

Hanger - Pantex has successfully converted these obstructive characteristics into the best practices documented by the BMP survey team.

Integrating and streamlining isolated systems and groups of personnel is critical to the survival of any business, and at Pantex that need also influences the optimum use of resources. The need is even greater to effectively plan, qualify, and quantify the required assets when the number of resources exceeds 3,000, project plans number in the hundreds, and tasks top 30,000. Pantex's Integrated Site Planning system facilitates the implementation of project-based management in a functionally-oriented organization and provides better utilization of its resources. By evaluating the resource allocation needed for various tasks, applying teaming concepts, and innovatively using off-the-shelf software, Pantex can now plan and balance annual workload requirements, and shift or share resources to meet scheduling requirements. This has eliminated essential resources standing idle while others are tasked at over 100%.

The innovative application and distribution of technology to industry is another area with which DOE sites have been tasked. At the Pantex plant, this objective has been met through the successful integration of a research instrument into a production facility environment. Using a mass spectrometer, Pantex can accomplish analysis in nearly half the optimum turnaround time. The plant can provide a rapid response to its customer with its capability to analyze 10 samples per day with excellent quality control. Extensive training and stringent quality requirements are critical components to this response time. Technicians are qualified on all spectrometer types, and pass exacting tests on each type, with requalifications required on operational evaluations every two years. Machine calibration is conducted on a continual, regulated basis for each gas, and a certified primary quality control premix is analyzed prior to sample analysis to ensure quality control. These premixes are similar to samples being analyzed to reduce uncertainties and are also analyzed after the completion of sample analysis to ensure accuracies. This outstanding capability to accomplish research precision and quality analysis in a production environment positions Pantex among the best in mass spectrometry analysis and is an applicable technology for industry.

Benchmarking outside the confines of the facility represents a new effort for Pantex. When the company looked to develop and implement a management information system, Pantex turned to companies such as Boeing,

Martin Marietta, and Battelle to determine best-in-class practices. As a result, the Work Authorization Control System II, internally developed since 1993, now integrates all requirements for formalized business planning, scheduling, costing, performance measurement, and change control to provide management with real-time decision making information. Pantex assembled a multi-function project team that included top management and information services personnel to supervise this important development and implementation. Through its benchmarking efforts and aggressive development of the system, Pantex now has a highly-effective system to plan and control all work and costs because of the total integration of the information with other planning and management systems.

Finally, these best practices would not be possible without strong management commitment and a conscientious work force. There is a high level of dedicated and technically competent personnel at Mason & Hanger - Pantex, acquired from years of experience and expertise in many of the technologically-related processes. Both management and the workforce are committed to ensuring that the work at the Pantex plant is of the highest quality, while providing the U.S. industrial base with benefits derived from supporting the mission of the facility.

This facility is in a strong position to meet the new needs of the Department of Energy triggered by changes in the world environment. Integrating its capabilities, applying its developed technology, and initiating benchmarking beyond the facility's borders are highlights of the following best practices at Pantex deemed among the best by the BMP survey team to be among the best in government and industry.

Best Practices

The BMP survey team documented the following best practices at Pantex.

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High Energy Radiography	7
The Non-destructive Evaluation Lab at Pantex has designed a state-of-the-art facility encompassing excellent capabilities in high energy radiography. Several systems are utilized for the evaluation of thick sections of very dense materials such as uranium and tungsten alloys.	
Laser Sampling	7
Pantex uses an exceptionally sophisticated laser sampling technique to certify the correct gas fill for pits manufactured off site and to characterize	

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the aging effects in the pits to determine any radiolytic decomposition.	
Mass Spectrometry	8
Mason & Hanger - Pantex has successfully integrated a research instrument into a production facility environment. By using a mass spectrometer, Pantex can accomplish analysis in nearly half the optimum turnaround time. Extensive training and stringent quality requirements are critical components to Pantex's rapid response time.	
Cycle Time Reduction	8
Mason & Hanger's Seven-Step Process Improvement Method redefines cycle time reduction by devising a method that structures the process for analysis. This simple method defines the process boundaries and scrutinizes the different internal processes to reduce their duration and has been proven to be effective in reducing the overall cycle time.	
Disassembly Information System	9
Mason & Hanger - Pantex needed an integrated product to support both nuclear weapon assembly and disassembly activities in a highly controlled environment. Consequently, it successfully developed an information system to integrate its disassembly process into the overall tracking process, and a centralized tracking system was used to trace disassembled parts along with all parts inventory.	
Sitewide Environmental Impact Statement	10
Pantex has taken a proactive approach to fulfilling its Sitewide Environmental Impact Statement responsibilities by making information available to the public that is understandable, timely, and accurate.	
Pantex Pollution Prevention	10
Pantex's successful Pollution Prevention Program relies heavily on an initial Pollution Prevention Opportunity Assessment that emphasizes implementing preferred options to pollution prevention.	
Treatment of High Explosive Contaminated Groundwater	10
By successfully applying the results from a treatability study on high explosive contaminated	

Item	Page	Item	Page
soil and groundwater, Mason & Hanger - Pantex has been able to treat the soil without the risk of lowering the water table in treated or downstream areas.		External Dosimetry Exchange Cost Effectiveness	13
Facility Management Integration	11	The Dosimetry Section of the Environment, Safety and Health Division at the Pantex plant uses an efficient method for issuing, collecting, calculating, and reporting radiation dose information. Through the application of a data collection system using a Dosimetry Records Management System for dose processing, the Dosimetry Section can report results within seven days, and costs are kept low by analyzing employee dosimeters in one night, thereby requiring only one dosimeter per employee.	
Using off-the-shelf software and reengineering its configuration related processes, Pantex is successfully integrating its engineering designs, facility documents, and physical plant configuration by applying a graded approach of sequential implementation.		Internet Security Program	14
Integrated Site Planning	12	Pantex developed an advanced security program to safeguard and manage the company's Internet resources. Application of the zero tolerance policy for internal abuse of the Internet has effectively eliminated all unauthorized use of the Internet at Pantex.	
Pantex's Integrated Site Planning system facilitates implementation of project-based management in a functionally-oriented organization, and provides better utilization of almost 3,700 resources. Planning and resource allocation for approximately 160 project plans with over 30,000 tasks has been successfully demonstrated using this system performed with Microsoft Project, a project server, and application of teaming concepts.		Medical System Software	15
Utility Locator Program	12	The Information Management Division developed a medical software system to streamline and consolidate Pantex's ability to maintain employee medical records. The new system has improved communication on the two crucial entries of timely injury and work restriction notifications.	
Mason & Hanger instituted a Utility Locator program in 1993 to reduce utility cuts caused by excavation. By marking and recording utility locations, the Pantex plant has reduced costs, improved safety, and reduced outage impacts to manufacturing and support organizations.		Performance Indicators	15
Compensation Administration	12	Pantex has an aggressive Performance Indicator program driven by management commitment and involvement, and is based on individual accountability. Continuous improvement is achieved by establishing effective performance indicators for all processes, timely diagnosis and corrective actions, and training for all personnel.	
Mason & Hanger - Pantex established a Compensation Program in 1990 to address a critical inability to recruit and retain required talent for business growth. The program allows maximum flexibility in the pay structure to attract, retain, and motivate top talent.		Security Awareness Program	16
Explosives Safety Compliance	13	Security Awareness Program personnel at Pantex are responsible for translating germane DOE orders into Pantex Plant Standards, and training all plant employees on security awareness tactics. This is accomplished through extensive training of all plant personnel, using modern technology such as computer-based training, through self assessments of the security awareness program, and through monitoring of key performance indicators.	
Mason & Hanger applies a proactive management program to address explosives safety problems at its Pantex plant. A high-explosives tracking system was developed to track non-compliances to completion or resolution, and there is now maximum visibility for all non-compliance efforts and results.			

Item	Page	Item	Page
Special Reaction Team Training Program	17	Radiological Assistance Team and Accident Response Group Vehicles	21
The highly effective training program for Pantex's Safeguards, Security, and Fire Protection Division's Special Reaction Team produces efficiencies in the number of trained personnel, satisfaction of customer requirements, fiscal efficiencies, and technological advantages.		Pantex maintains two teams as part of its response program to radiological or nuclear accidents. To support these critical teams, Pantex has purchased additional vehicles and equipment to ensure that both groups are adequately supplied.	
Task Order Contracting	17	Subsurface Interface Radar	21
Pantex routinely uses task order contracting for flexibility in quickly acquiring a wide variety of services from commercial organizations. The principal mechanism to accomplish this is the Task Order Agreement, a written unpriced agreement signed by both parties containing a description of services to be provided; methods for pricing, issuing, and delivering future requirements; and terms and conditions that apply to orders placed during the term of the Agreement.		Subsurface Interface Radar Technology was applied at the Pantex facility when faced with a need to inspect and map the aging infrastructure and buildings of the facility. This application is used to detect and map reinforcement steel bars in concrete.	
Training and Development	18	Utility Systems Reliability	22
The employee training program and practices at Pantex have emerged as models for other DOE laboratories. The program benchmarked numerous facilities to gain insight to already existing materials, programs, and ideas. Plans were developed and implemented based on the results of this study.		Mason & Hanger - Pantex's Utility System Reliability performance measurement system reduces utility downtime by improving the planning and scheduling of operations and maintenance of utility systems for maximum productive performance.	
Work Authorization Control System II	18	Accounts Payable	22
Pantex has developed and implemented a management information system which integrates all requirements for formalized business planning, scheduling, costing, performance measurement, and change control to provide management with real-time decision making information.		The Pantex Accounting Department has successfully applied continuous improvement principles to improve the productivity of its accounts payable process. The Accounting Department has subsequently reduced the average age of outstanding accounts payable from 46 days to 20 days -- a 55% reduction.	
Information		Breathing Zone Monitoring	23
The following information items were highlighted at Pantex.		Pantex modified a procedure in 1994 to monitor the workplace for airborne radioactive materials. This change in procedure allowed dosimetry personnel to respond more quickly to potentially undesirable readings.	
Item	Page	Classified Matter Protection and Control Program	23
Geographical Information System	21	The Classified Matter Protection and Control Program maintains four critical objectives at the Pantex plant by providing training tracked through a central training database and reminding employees through printed and electronics means of Classified Matter Protection and Control matters.	
Mason & Hanger - Pantex has developed an Integrated Environmental Database/Geographical Information System that consolidates all environmental records at the plant site into one centralized location.			

Item	Page	Item	Page
Communications Security Material Records System	23	Neutron Dose Calculation Method	26
As the result of two events, Pantex upgraded its manual, hard-copy Communications Material Records system to facilitate locally maintaining accountability of crypto materials, cryptographic equipment, controlled cryptographic items, and other Communications Security Material Records materials. The Defense Nuclear Agency appointed Pantex the historical repository for all old cryptographic materials, and, the agency also began a number of changes which resulted in a significant increase in the volume of materials tracked.		The Pantex plant personnel developed a neutron dose calculation method to correct a number of undesirable factors, and measures can now provide accurate neutron dose values to the work force, determine Pantex plant site specific neutron correction factors, and upgrade the neutron dose monitoring program.	
Document Management Program	24	Property Accountability	27
The Pantex document management program for managing active, controlled operating documents encompasses document indexing and revision control, document change control, and access and distribution of documents. These modules are part of the company's integrated information management systems.		The property accountability system employed at M&H - Pantex has the capability to track sensitive personal property throughout their respective life cycles. M&H's system has an inventory accuracy rate of 99.5%.	
Electronic Purchasing System	24	Quality Assurance Program	27
The Pantex Financial Inventory Procurement System electronically processes material and services purchases and has resulted in a reduced acquisition cycle, improved process accuracy, full traceability, and paper reduction.		Pantex has integrated a Quality Assurance Program into its management system as an employee-owned process. In 1990, the company consolidated external requirements into policy directives that cross division lines and integrate specific functional areas of quality.	
Emergency Operations Center	25	Radiological Monitoring System Maintenance Training	28
The Emergency Operations Center facilities at Pantex are being upgraded in response to the need for a fully-operational, highly-capable Center that is critical to provide immediate, coordinated, plant-wide emergency response.		Pantex has instituted a unique training program for its maintenance personnel. The Radiation Alarm Monitoring System, initiated in 1994, ensures consistent and accurate testing and maintenance of various control systems used throughout the facility.	
Labor Relations	25	Review of Bioassay Data Analyzed Off Site	28
Since 1988, Pantex has experienced gradual, continuing improvement in labor-management relationships marked by decreased grievance and arbitration activity, improvement in operational efficiencies, increased employee involvement, and better communications.		Pantex generated an internal operating procedure in 1995 to effectively monitor bioassay analyses performed by off-site vendors. This program was established in response to DOE concerns about the analyses results, the need to establish quality assurance and control methods, and establish a level of confidence with the off-site analytical laboratories.	
Metrology Calibration Quality Control System	26	Safeguards and Security Self-Assessment Program	28
Mason & Hanger - Pantex is developing a Metrology Calibration Quality Control System to help the division manage the calibration cycles and ratios of all calibrated items used at the facility.		The Safeguards, Security and Fire Protection Division of the Pantex plant utilizes a comprehensive program to validate the Site Safeguards and Security Plan, and to establish a baseline against which to evaluate continuous improvements.	

Item	Page	Item	Page
Security Force Training	29	Standardized Hardware and Software	30
Mandatory skills training and recertification training for a large, diverse security work force presents a challenge for the training personnel at Pantex.		Pantex standardized its hardware and software computer systems and applicable networks to meet the needs of network integration, information sharing, and cost containment.	
Small Purchase Order Credit Card System	29	Vital Records Protection Program	30
Mason & Hanger - Pantex produced a significant reduction in processing small purchase orders through the use of a small purchase order card system. Using the credit card system has allowed personnel to reduce procurement delay time, and improve the account payable system by reducing the procurement labor for small purchases from 53 hours to 19 hours per purchase.		The Mason & Hanger - Pantex plant is implementing a formalized program to protect all company vital records from loss due to accident, fire, flood, and sabotage by placing them on microfilm formats.	
Socioeconomic Purchase Program	29	<i>Point Of Contact</i>	
The socioeconomic purchase program at Mason & Hanger - Pantex promotes small businesses, small disadvantaged businesses, minority businesses, and women-owned businesses. This program employs a subcontracting specialist to review proposed purchase requirements and contact local communities to determine if residing small businesses are available and capable of meeting the terms of the requirements.		For information on any item in this report, please contact:	
		Mr. Finnis Hughes	
		Mason & Hanger Corporation	
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		Amarillo, TX 79177	
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		FAX: (806) 477-6601	
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Section 2

Best Practices

Test

High Energy Radiography

The Non-destructive Evaluation Laboratory at Mason & Hanger - Pantex has designed a state-of-the-art facility encompassing excellent capabilities in high energy radiography. Several systems are utilized for the evaluation of thick sections of very dense materials such as uranium and tungsten alloys. Future capabilities will enable Pantex to become world-class in non-destructive evaluation of nuclear test items.

There are five linear accelerators in separate operating bays, from 2 MeV to 9 MeV, each with real-time capability. External collimation with laser beam alignment is common to three of these systems. Variable alignment of the beam on stationary objects is obtainable by flexible positioning of an x-ray head with five-axis movement. Precise alignment of the beam greatly enhances resolution of a selective part while minimizing object distortion and reducing radiation scatter (Figure 2-1). Remote operation of the positioning table aids in accurate evaluation of test items.

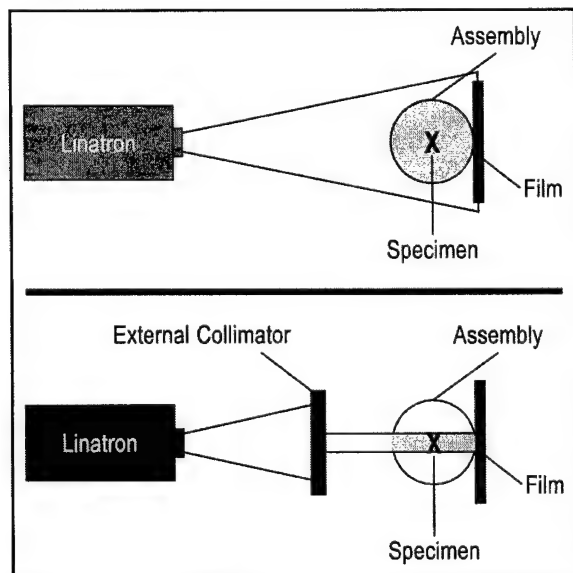


Figure 2-1. Beam Collimation

Pantex has satisfied all local and federal regulations in radiation safety while increasing the safety of its employ-

ees by implementing the Rad-Safe System. A closed circuit TV system for remote viewing of test bays combined with remote monitoring of gamma radiation at various locations in and around exclusion areas greatly reduce the possibility of radiation exposure to personnel. The Rad-Safe System has microprocessor-controlled functions for current sensing on warning devices. If failure occurs, the machine becomes inoperable. Personnel verify the Rad-Safe System prior to every shift by simulation of system failures.

Both personnel qualification and quality control requirements exceed industry standards. Density measurements of inspected items are maintained at a density reading of 2.4, with a tolerance of ± 0.4 . Training requirements in radiation-specific areas are in excess of 460 hours, given on a biannual basis.

In pursuit of its goal of world-class recognition, Pantex recently added a 9 MeV Computer Tomography System. Upon approval from regulating agencies, Pantex will have an unparalleled high-resolution capability for nuclear test items.

Laser Sampling

Mason & Hanger - Pantex uses an exceptionally sophisticated laser sampling technique to certify the correct gas fill for pits (spheres of plutonium hermetically sealed in metallic shells that comprise the cores of nuclear weapons) manufactured off site. It is also used to characterize the aging effects in the pits to determine any radiolytic decomposition. It is critical to collect enough volume to be analyzed, yet small enough so as not to deviate the existing fill from specifications. This must also be done without degrading the hermetic integrity of the component and without exposing personnel to any radioactive contamination.

In use since 1983, the technique uses a highly-focused and collimated infrared laser beam. Laser pulses are transmitted through an optical window to drill a 0.1 mm diameter hole in the stainless steel pit tube with a wall thickness of 0.7 mm. A small (10cc) gas sample is collected and sent to the Gas Analysis Laboratory for examination. Drilling of the pit tube by the laser is accomplished in a completely enclosed cabinet to protect the operator from exposure to any radiation or laser hazards. By using enclosures and tooling designed and built in-house, gas samples are extracted through a sealed manifold system

under vacuum conditions. The tube is then resealed by welding the drilled hole closed using the same laser (Figure 2-2). Each component is leak-checked prior to and after the laser sampling. A simulation coupon is processed

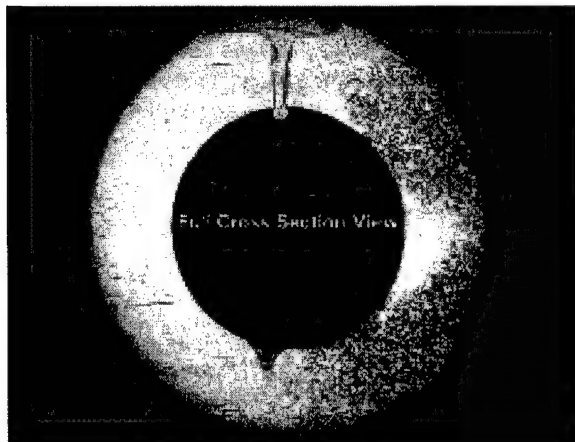


Figure 2-2. Tube Weld

using the laser before and after each day's operation. These dummy tubes are manufactured to component material specifications and are sectioned and photomicrographed by the Metallurgy Laboratory to monitor the laser weld performance. All welds undergo a microfocus radiography to measure the fill depth and quality of the weld.

Laser sampling has proven to be an effective method for analyzing high hazard contents housed within high-value sealed containers. This application has provided minimal exposure to personnel, and is planned for expansion to include evaluation of other containers and components for various chemical analysis. It may also be used to support the disposal of highly hazardous military chemicals.

Mass Spectrometry

Mason & Hanger - Pantex has successfully integrated a research instrument into a production facility environment. By using a mass spectrometer, Pantex can accomplish analysis in nearly half the optimum turnaround time. Pantex provides outstanding precision customer response with its capability to analyze 10 samples per day with excellent quality control. Extensive training and stringent quality requirements are critical components to Pantex's rapid response time.

Training for technicians includes qualification on all different spectrometer types at the plant. Technicians must pass both a thorough written test and an extensive operational evaluation for each type of mass spectrometer, and technicians are requalified every two years with an operational evaluation on each type. This training ensures

readiness in the production process and expedites the analysis.

Each machine is calibrated daily with a pure gas standard of nitrogen and weekly with pure gas standards of CO₂, argon, CO, and O₂. The machines receive calibration bi-weekly and monthly for other gases and special calibrations are run only as needed. For quality control, a certified primary quality control premix is analyzed prior to sample analysis. These premixes are similar to samples being analyzed to reduce uncertainties, and are also analyzed after the completion of sample analysis to ensure accuracies.

Pantex's ability to accomplish research precision and quality analysis in a production facility environment places it among the best in mass spectrometry analysis. This is accomplished through its rigorous quality assurance program and exhaustive qualification of technicians.

Production

Cycle Time Reduction

Mason & Hanger - Pantex's Seven-Step Process Improvement Method redefines cycle time reduction by devising a method that structures the process for analysis. By defining the process boundaries and scrutinizing the different internal processes to reduce their duration, the Seven-Step process has been proven to be effective in reducing the overall cycle time. This simple method is applicable to a variety of processes from business and administrative practices to manufacturing-related areas.

The first step, **defining process boundaries**, includes determining what constitutes the beginning, end, inputs, and outputs of the process. Through initial familiarization of the process, measurement metrics can then be determined. This step is followed by **observing the process**. Every process step is recorded and the flow is detailed to include intermediate steps. Process steps are also categorized for ease of observation (Figure 2-3). At this point, **process metrics are collected**. Each step of the process is timed, including transition from one subprocess to another subprocess. **Collected data is then analyzed**, and the cost of individual steps as well as the total process cost are then determined. It is then easy to **identify improvement**

#	STEP DESCRIPTION	FLOW	TIME (MIN)	RESOURCES	NOTES
1	Component A Assembled	○	15	1	
2	Transferred on Conveyor	→	5		
3	Component A Attached To B	○	20	1	
4	Transferred on Conveyor	→	5		
5	Waiting for Quality Inspection	▽	300		
6	Assembled Components Inspected	□	10	1	

Figure 2-3. Process Analysis Worksheet

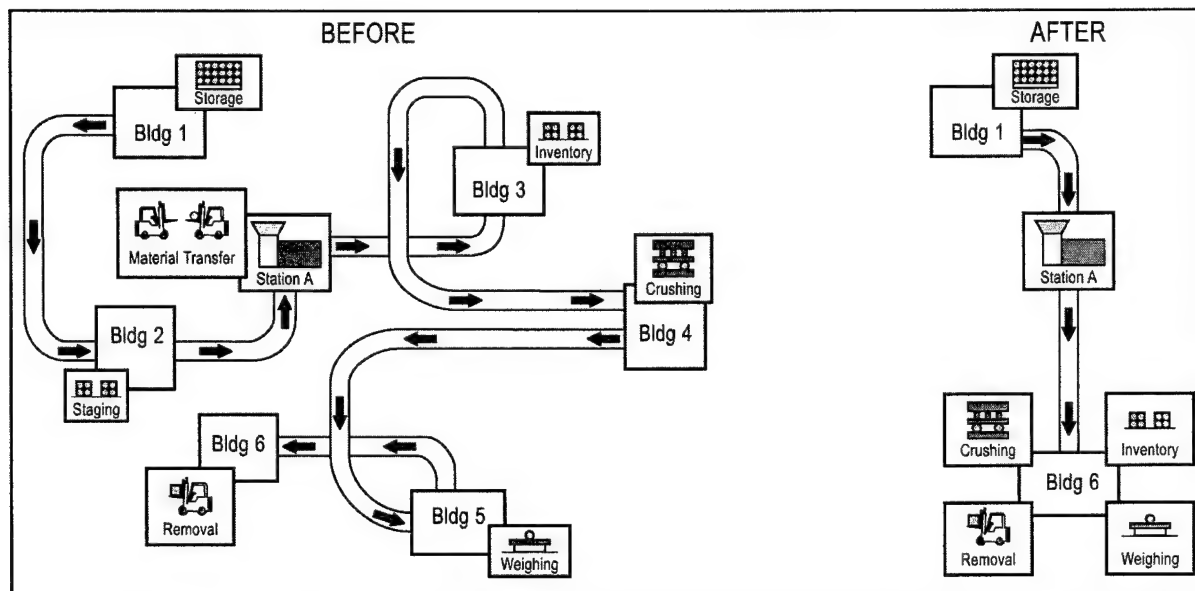


Figure 2-4. Before & After Work Flow Improvements

areas. Areas are obvious such as unnecessary and time-consuming transportation and delay steps, redundant inspection steps, inefficient process sequences or flows, inefficient process layouts, and unnecessary rework steps. After identification of improvement areas, **appropriate improvements are developed**. This step may consist of restructuring the entire flow by eliminating, minimizing, and/or combining several tasks into a few (Figure 2-4). Another option may be a simple repositioning of an employee on an assembly line. The final stage, **implement and monitor improvements**, includes implementing the improvements which are then monitored and compared for refinement or enhancement.

Mason & Hanger has realized significant cycle time reduction as high as 95% as in the Industrial Hygiene Building Survey, or potential dollar savings of over \$36K in a Reprographics effort. Future plans include applying this method to a larger number of Pantex processes.

Disassembly Information System

Mason & Hanger - Pantex needed an integrated product to support both nuclear weapon assembly and disassembly activities in a highly controlled environment. Consequently, it successfully developed an information system by enhancing existing manufacturing software developed by Computer Associates (CAS). Pantex integrated its disassembly process into the overall tracking process, and a centralized tracking system was used to trace disassembled parts along with all parts inventory. With only one user interface for both business processes, training was

reduced and the need for two separate systems was eliminated.

Pantex combines both operations into one because both activities are not segregated by product line or location. The functionality of the disassembly process consists of a reverse bill of material with part disposition definitions and also automatic order generation. Using the existing CAS transactions to support both processes, the disassembly process has been integrated into the material tracking system. Barcoding is also utilized. The enhanced disassembly software also supports material definition and planning and produces a projected available balance for both activities. With the automation of planning and scheduling of disassembly orders, the number of transactions necessary for warehouse processing was reduced, and shop floor audit information was improved. The modification of disassembly orders that are in process is also automated.

Mason & Hanger has implemented a closed loop system that uses only one user interface for the assembly and disassembly activities in a highly-controlled, highly-traceable environment. It has realized a \$3M annual savings from enhanced inventory control and tracking, and the improved weapons production coordination resulted in \$4.5M annual savings. The company saves the DOE \$7.5M annually now that this disassembly system is in use. Future planned enhancements are projected to realize \$24M in annual cost savings for the DOE. This process has widespread application in reutilization programs in many fields.

Sitewide Environmental Impact Statement

Mason & Hanger - Pantex has taken a proactive approach to fulfilling its Sitewide Environmental Impact Statement (EIS) responsibilities by making information available to the public that is understandable, timely, and accurate. With a "They're Not Going to Come to You" attitude, Pantex has combined electronic and print media, public information sessions, speaker bureau activities, employee public speaking and media training, and media seminars to form a comprehensive program delivering the Pantex EIS message.

Pantex began this effort by preparing and implementing a Stakeholder Involvement Plan. The EIS stakeholders were identified as government (federal, state and local entities), the media, adversary groups, community leaders, the educational community (students and teachers), and the general public. The Stakeholder Involvement Plan represented the initial step in activities designed to maximize public involvement in EIS. Pantex contacted landowners, interest groups, and state and local officials to apprise them of the EIS process and to publish a schedule of planned activities. Activities included establishing a 24-hour EIS information hotline to handle information and speaker requests. This step was followed by distributing brochures and a quarterly EIS newsletter. Pantex EIS team members appeared on radio and television talk shows, and they produced a video used at public meetings and speaker bureau events. This video was made available to Pantex employees and interested stakeholders.

An Information Fair was held in anticipation of the May 1995 DOE public (Scoping) meeting. The Fair provided exhibits and presentations on EIS topics such as radiation safety, groundwater and overflight issues, as well as opportunities for citizens to talk with Pantex technical staff about their EIS concerns and questions. Pantex found the Fair to be so successful and well received that it was repeated the following year and is now slated to be an annual event.

Following the Scoping meeting, Pantex continued its outreach and awareness activities through additional activities including:

- a Cultural Resources Program to foster involvement of interested Native American tribes,
- a downtown Pantex Information Office to provide information to city residents,
- a children's video, coupled with Pantex EIS team presentations to public, private, and home school audiences,
- an essay contest for students to write about "What I Learned at the Pantex Information Fair," (winners received a monetary prize and special plant tour),

- a multimedia, touch screen kiosk information center about Pantex and EIS available to the public in high schools, malls, post offices and libraries, and
- a Pantex EIS Internet Home Page.

All of these Pantex EIS activities demonstrate the aggressive and encompassing approach to meeting the company's National Environmental Protection Act responsibilities. Positive indicators of Pantex EIS success include its nomination in 1995 to receive the Secretary's Award, and an invitation to discuss the entire National Environmental Protection Act process at the Spectrum '96 International Meeting in which the program will be featured as a seminar.

Pantex Pollution Prevention

Pantex's successful Pollution Prevention (P2) Program relies heavily on an initial Pollution Prevention Opportunity Assessment (PPOA) that emphasizes implementing preferred options to pollution prevention. The eight steps to the Battelle - Pantex assessment include selecting a waste stream and defining boundaries; establishing a PPOA team and appointing a team leader from the P2 group; performing a material balance of materials crossing the system boundaries; developing options; analyzing options; selecting the preferred option; implementing the preferred option; and validating the impact of implementing the preferred option. The Pantex P2 Program does not close out a project until after the preferred option is implemented. This effort includes evaluating the performance of the members of the P2 group by assessing the number of implemented P2 projects.

Projects are selected for the P2 program based on consideration of the Pantex Plant Top 150 Waste Stream List, employee suggestions (including a program where employees can share in dollar savings realized by implementing suggestions), and material evaluation forms. Employee attitude has been affected positively by training, by the P2 group realization that they are a service organization, by working to keep the customer happy, and by validating the results to ensure that the customer remains happy. This has resulted in a 756% return on investment of annualized savings associated with FY95 P2 projects.

Treatment of High Explosive Contaminated Groundwater

By successfully applying the results from a treatability study on high explosive (HE) contaminated soil and groundwater, Battelle - Pantex has been able to treat the soil without the risk of lowering the water table in treated or

downstream areas. The study showed that HE contaminations of groundwater could be removed and remediated by dual phase extraction of unsaturated and saturated zones. Results from drilling test wells showed that past practices of flushing contaminants into drainage ditches at the facility had contaminated only perched aquifers and underlying flats and not the main drinking water aquifers used by many states in the southwest.

The treatability study was tasked to:

- demonstrate that the groundwater level could be lowered sufficiently to expose the capillary fringe zone for volatile contaminant removal by vacuum;
- assess the ability of the system as designed to expose the capillary fringe zone and remove volatiles by directing air from passive vent wells through the groundwater extraction wells;
- determine optimum well spacing and the radius of influence for additional or future groundwater and or vapor extraction wells;
- assess the ability of the dual phase groundwater/vapor extraction to be operated over an extended period of time in which to obtain reliable design parameters and other performance data for refinements to the existing system or a full scale treatment system;
- assess the effectiveness of the carbon absorption system for removing HE components from the groundwater; and,
- develop field-proven design criteria and equipment specifications for future remedial activities at Pantex.

Test wells were drilled to locate and define the flume of contamination. From the test well data, Pantex engineers determined where to drill the required dual-phase wells to begin decontamination. After installing the system, data and analysis revealed that the treated groundwater was of sufficient purity to allow its reuse, thereby avoiding pumping it to the wastewater treatment facility for further treatment and disposal. These findings allowed Pantex engineers to modify the process design.

The modified design calls for the same drilling of dual-phase wells along with the strategic location and drilling of injection wells to reuse the decontaminated water. Geological survey data and computer modeling provides needed information to maximize the treatability area and optimize well placement.

Facilities

Facility Management Integration

Using off-the-shelf software and reengineering its configuration management-related processes, Mason &

Hanger - Pantex is successfully integrating its engineering designs, facility documents, and physical plant configuration. Since 1993, Pantex has maintained a vision to become a model for facility configuration management in an environment where dangerous products are manufactured. To achieve this Facility Management Integration, Pantex has applied a graded approach of sequential implementation to include business and software application solution sets such as Core Configuration Management, Material Management and Administrative Services, and Safety and Compliance.

Pantex had to maintain absolute consistency between engineering designs, facility documents and the physical plant configuration. A computerized solution was required because changes occur continually within one of these three elements. PassPort was selected as the optimum software to meet this need. The Core Configuration Management set includes Work Management, Personnel Qualifications, Document Management, Engineering Change, and Action Tracking business processes and software modules. Installation of this initial set was begun in March 1994 and completed two years later. During the first year of production use, the system supported over five million transactions, 733 users were trained, 35,000 documents were indexed, a reported \$800K cost avoidance savings was realized, \$290K in tangible cost savings was calculated, and an average of over 5,000 work orders per month was transacted.

Installation of the Material Management and Administrative Services set which includes Inventory, Purchasing, Contract Management and Accounts Payable applications began in January 1996 and is scheduled for completion in February 1997. The third set (not currently scheduled or funded) is Safety and Compliance which includes Equipment Tag Out, Material Safety Data Sheets Management, and Total Exposure and Health Physics. A fourth set containing technical products that are needed to support the other three sets is being implemented as specific product functions and capabilities are required.

By following this prudent approach to total configuration management, M&H is achieving its original goal of making Pantex the model for others to follow. This is the first site to place multiple PassPort modules in actual production use within one year of purchase. In addition, there is concurrent production implementation of five PassPort application modules, and this is the only site to support a Portl/G graphical interface for both Windows and OS/2 desktop, as well as integrating WordPerfect documents into the system. Finally, this Pantex site is the only one with fully functional interfaces to labor, accounting, and personnel data.

Integrated Site Planning

Mason & Hanger - Pantex's Integrated Site Planning (ISP) system facilitates implementation of project-based management in a functionally-oriented organization and provides better utilization of almost 3,700 resources. In evaluating the resource allocation needed for various tasks, Pantex determined that some tasks required the use of the same resource. As a result, many of these required resources equated to an excess of 100% of the planned allocations needed to successfully accomplish assigned tasks, while other resources were standing idle. In an effort to accurately plan and balance resource allocations, Pantex implemented the ISP system.

This system provides management needed information to plan, qualify, and quantify the resources required to accomplish multiple tasks. It also provides a means to plan and balance annual workload requirements, and the ability to shift or share resources to meet scheduling requirements. Planning and resource allocation for approximately 160 project plans with over 30,000 tasks has been successfully demonstrated at Pantex using this ISP system performed with Microsoft Project, a project server, and application of teaming concepts.

Utility Locator Program

Mason & Hanger - Pantex instituted a Utility Locator program in 1993 to reduce utility cuts caused by excavation. By marking and recording utility locations, the Pantex plant has reduced costs, improved safety, and reduced outage impacts to manufacturing and support organizations.

The plant had seen increased construction activities including utility upgrades, and determined that it was necessary to gain control over the process by improving documentation and involving personnel in the process. Previously, construction personnel submitted an excavation permit, and locating utilities was only a part-time job. Location maps of utilities were marked-up sheets with no configuration control -- these sheets were stored in locators' lockers. Utilities were installed without trace wires; when utilities were cut, they were not documented for baseline data.

The excavation request process is now centralized and is delineated in a plant standard. The excavation requirements for Pantex are defined for construction contractors. A team of dedicated locators survey the requested excavation area and mark the utilities. A plant utility map is loaded in a CAD/CAM system for easy upgrade. This map is reviewed by the locators prior to area surveys and upgraded after each survey is conducted. Special equipment (such as a MetroTech model 9860 and a Radiotronics

model RD 312) is used to determine the location of different utilities.

Benefits realized by this program include reduced outages, reduced cut utilities, and better metrics to be used in self evaluation. Table 2-1 highlights the improvements seen by the Pantex plant since the program's implementa-

Table 2-1. Utility Locator Evolution

	1993 ¹	1994	1995	1996 ²
Utilities Marked	Unknown	2,016	2,492	1,212
Marked & Cut (% of total)	40	48 (2.3%)	41 (1.6%)	20 (1.6%)
Unmarked & Cut (% of total)	2	22 (1.1%)	5 (0.2%)	0 (0%)
Cut Utilities NOT Shown on Plant Maps	15	53	31	6

¹ Data Incomplete
² Data for 1/96 thru 4/96

tion. The importance of documentation was realized to be a key to a successful program along with the dedication for process improvement. M&H is continually investigating alternate methods of location in order to eliminate utility cuts. For example, new locating equipment is being investigated such as ground penetrating radar, acoustical tracking equipment, and tone/voltage tracking capabilities.

Management

Compensation Administration

Mason & Hanger - Pantex established a Compensation Program in 1990 to address a critical inability to recruit and retain required talent for business growth. This DOE-certified program established the salary structure for the workforce and correlated pay with job function and performance. It also matched pay structure with locale, employee performance indicators, and provided substantiating data. Salaries and pay structures, although generally in compliance with DOE regulations and Mason & Hanger corporate offices, were not adequate to maintain the workforce. Developing a new salary structure was required; however, many issues needed address before such authorization/certification could be given by DOE and corporate headquarters. Specific issues to be resolved included the lack of correlation between pay and performance, lack of supporting data, difficulty in presenting supporting data, legal concerns, and a shortage of performance criteria.

The Compensation Program has helped Mason & Hanger - Pantex implement practices toward certification. The company has looked at new processes for job evaluation,

performance management, market pricing, annual compensation increase plan budgeting, and an information system for capturing, computing, and presenting the data. A customized automated job evaluation system helps Pantex collect personnel qualifications and job descriptions using CompMaster software by Mercer Corporation for converting the data to a score.

The performance management system collects and correlates data that represents the changing business environment, management strategies, and Pantex goals. Data is readily available electronically or archived for audit and validation. Market pricing provides indicators for setting salary ranges that are tied to the market. The program benchmarks the population, makes comparison with other companies, and reviews the Organizational Resource Counseling and Salary Information Resource System. The annual compensation increase plan budgeting process automatically correlates pay to performance. Assessability of compensation information is made available to line management through the Human Resources Information System.

As a result of these activities, Mason & Hanger Pantex Compensation Program has received certification from DOE and is in full compliance with Mason & Hanger corporate policy. The program allows more flexibility in the pay structure to attract, retain, and motivate top talent, and the hiring ratio has now improved to 1.1. Turnover has been reduced to less than 5% over the previous 10%. Automation of the system has allowed large reductions in cycle time for tracking trends, conducting audits, and processing data.

Explosives Safety Compliance

Battelle - Pantex applies a proactive management program to address explosives safety problems at its Pantex plant. Before 1994, responses to correct explosive safety issues by facility managers were minimal. Survey findings were initially forwarded to the facility managers, but due to workloads and daily operations, managers were not able to address these explosives safety surveys in a timely manner. Explosives safety expertise was also dispersed across the plant, creating a decentralized situation. There was no single, authoritative point of contact to address the problems and provide the requisite expert guidance and follow-up for resolu-

tion. Consequently, a backlog of non-compliance problems built to almost 200 outstanding instances in March 1994.

A high-explosives tracking system was developed to track non-compliances to completion or resolution, and a monthly report was generated listing outstanding explosives safety findings. Explosives safety expertise resident in the plant was consolidated into a single organizational entity. This group, responsible for the findings, providing help, and guaranteeing follow-up, was augmented by the DOE Safety Assessment/Facility Evaluation Program that identified non-compliances with a risk assessment and code.

The results from implementing this program were highlighted by immediate improvement in resolved findings. The program was validated over a three-month period which resulted in even further improvements such as personal contact by the Explosives Safety Department staff to each facility manager. The Department offered help to abate non-compliance issues using the SAFE report as a common reference point. There is now maximum visibility for all non-compliance efforts and results, and significantly enhanced communication efforts. A centralized office for data, findings, help, and advice has resulted in quantifiable improvements in non-compliance abatement, and the trend has been significantly improved (Figure 2-5).

External Dosimetry Exchange Cost Effectiveness

The Dosimetry Section of the Environment, Safety and Health Division at the Pantex plant uses an efficient method for issuing, collecting, calculating, and reporting radiation dose information. The Battelle - Pantex external

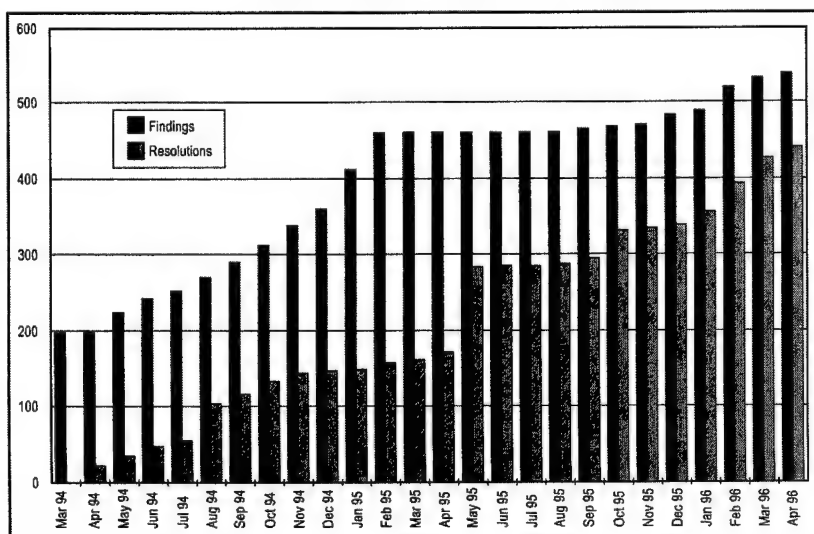


Figure 2-5. Non-compliance Abatement Trend Chart

dosimetry group -- with a staff of only two technicians and a supervisor -- analyze approximately 28,000 dosimeters per year. This number includes dosimeters for almost 450 visitors every month and employee dosimeters which are analyzed monthly or quarterly, depending on the employee's specific job content. By applying a proficient method, Pantex has realized significant improvements in reporting time and costs.

Employees leave their dosimeters in a central location every day when leaving the plant. Through the application of a data collection system using a Dosimetry Records Management System for dose processing, the Dosimetry Section can report results within seven days. In addition, costs are kept low by analyzing employee dosimeters in one night, thereby requiring only one dosimeter per employee. The process (Figure 2-6) has been streamlined to eliminate redundant steps, and extensive use of bar coding facilitates this efficient data collection process.

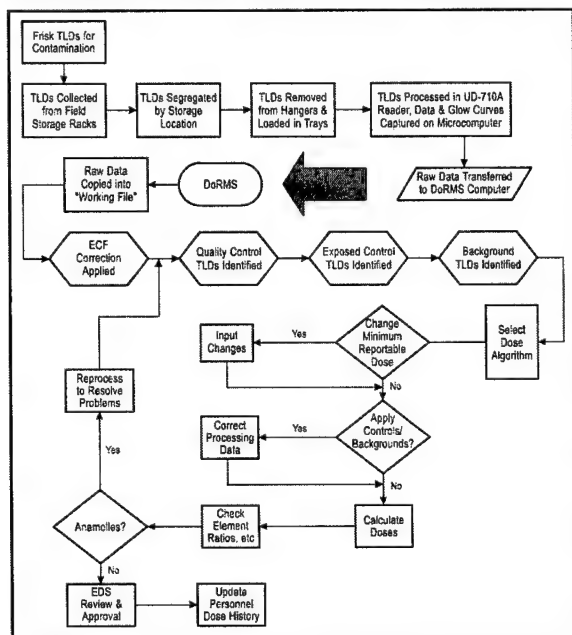


Figure 2-6. Routine TLD Processing

The Pantex Plant Dosimetry Section has been able to report results of dosimeter analysis in seven days, reduce the cost of exchanging and processing a dosimeter to \$2.50 per dosimeter (including the fully-burdened labor rate) from \$25 to \$150, and achieve a dosimeter exchange rate of 97% since implementing this process.

Internet Security Program

Pantex developed an advanced security program to safeguard and manage the company's Internet resources. Internet use had rapidly increased at Mason & Hanger -

Table 2-2. Internet Activity

	# USERS	TRAFFIC (# of Transactions)	# GETS (# of files downloaded)
1 Nov 95	70	7.8K	2K
31 Jan 96	362	14.5K	2.7K
29 Feb 96	445	20.0K	4.2K
19 Mar 96	509	28.5K	4.8K
Apr 96	620	27.9K	9.5K

Pantex (Table 2-2) and company policy asserted the right to protect its information assets and allow a zero tolerance for abuses on company equipment and time. Before July 1995, the Pantex site local network was essentially a closed environment with limited external communications capability. External communications were limited to a few dedicated encrypted lines and modems for Internet access and special requirements. The market-driven need for rapid access to current data and information to support manufacturing, procurement, waste management, and other core functions spurred the decision to install the Internet on the local network.

Effective security measures to protect the network were essential because the Internet was easy to use and computer networks were inherently subject to misuse and abuse. With any network open to the Internet, the potential existed for compromise or unauthorized transfer of proprietary data, unauthorized access, and unauthorized activities. Pantex responded to these challenges with a sophisticated array of defenses.

ANS firewall system network intrusion detector software (developed by Lawrence Livermore National Laboratory) has been installed as the first line of defense. Whenever an attempt is made to break through, the intruder's method is analyzed and a defense is developed against it. The same technique is applied for viruses. ANS firewall systems are continuously updated to protect them against new methods of attack.

Because some of these attacks are sophisticated enough to get through the firewall undetected, Pantex has installed two Sun workstations on the line to the network. One is located just before the firewall and the other is located just after the firewall. These workstations continuously monitor and compare traffic through the firewall and can detect a breach undetectable by the firewall. The line can then be interrupted before data is compromised. The Sun workstation on the outside of the firewall can detect intruders who repeatedly attempt to penetrate the firewall and traces them back to the source. One full-time employee maintains and monitors the network security system. The system generates nine daily reports on firewall activity.

Computer security also daily monitors and audits Internet usage logs to detect misuse and abuse of the system by Pantex employees and other authorized network users. Although all users on Pantex's unclassified net are eligible, users must obtain management authorization to obtain an Internet account, and individual Internet users are issued unique addresses. Users are authenticated each time they go out of the system through the firewall. Every Internet address accessed by a user is logged and checked to ensure it is an address that meets an acceptable business use. When questionable instances occur, the appropriate manager is notified and must report back disposition. In cases where Internet use is determined to be inappropriate, disciplinary action is taken against the user. All Internet authorized users receive training and annually sign a code of conduct. Abuse includes access to non-business web sites, excessive time spent browsing, sending non-business e-mail messages, and unauthorized use of modems. All significant issues of abuse or unauthorized system entry are reported to the Department of Energy.

Application of the zero tolerance policy for internal abuse of the Internet has effectively eliminated all unauthorized use of the Internet at Pantex. Measures to safeguard the system against unauthorized entry have been so effective that the classified portion of the Pantex network will soon be connected to the Internet. Pantex continuously reviews its security measures with other DOE facilities and enhances them as necessary.

Medical System Software

The Information Management Division developed a medical software system to streamline and consolidate Mason & Hanger - Pantex's ability to maintain employee medical records. Before 1994, the system included a Flow Gemini medical software database on a standalone Digital Equipment VAX/VMS. It had numerous limitations, and lack of adequate communication and common data reference capabilities made the text-based system cumbersome for its medical, safety, Workman's Compensation, and Human Resources staff users to access, use, and expand. Because each user group had segmented portions of the data, there was data redundancy, repetition, and unacceptable opportunities for error. Additionally, because the database was non-relational, it was difficult to query and limited in its ability to integrate with other data in the plant.

Over six months, the programming team comprised of five personnel developed a customized software system at an estimated cost of \$500K. The new system has improved communication on the two crucial entries of timely injury and work restriction notifications. The relational database allows integration of medical data with other plant data, as well as increases the data accuracy. Its client/server archi-

tecture and user-friendly, Windows-based configuration have contributed to its analytical capability, query tool reporting, and overall system functionality and effectiveness. System functionality has improved all aspects of employee medical/occupational history, follow-up, examination scheduling, on-line occupational injury/illness reporting, and restriction assignment reporting. Employee injury and medical leave tracking, surveillance and qualification programs, Worker's Compensation cases, and work accommodation measures are also examples of the system's functionality.

Medical follow-up accuracy has improved significantly, from 70% with the old system to 98% with the new one. Pantex is currently adding industrial hygiene to the medical system's capability and contend that it has application to other DOE facilities. The software also shows applicability to most industrial medical facilities.

Performance Indicators

Mason & Hanger - Pantex has an aggressive Performance Indicator (PI) program driven by management commitment and involvement, and is based on individual accountability. Continuous improvement is achieved by establishing effective performance indicators for all processes, timely diagnosis and corrective actions, and training for all personnel. The PI program fully meets all DOE requirements and was established in 1990 as a formal program. By the end of 1990, Pantex had expanded on the DOE program and begun to develop performance indicators extensively throughout the site.

There are several levels of performance indicators:

- 22 major performance indicators are mandated for tracking and reporting by DOE,
- 36 Business Management Oversight performance indicators, and five specific incentive areas (negotiated annually with DOE),
- 23 plant-level PIs developed by senior plant managers in consultation with DOE, and
- approximately 600 lower-level PIs internal to Pantex.

Figure 2-7 illustrates the PI process for plant level indicators. The process is documented in a formal plant standard document. Plant level PIs are selected by senior managers, and each PI is assigned an Owner and a Data Contact. The Owner is the manager accountable for that PI and is responsible for setting measurable, realistic goals for the indicator. The Owner also monitors performance, initiates actions as necessary, and monitors lower-level PIs tied to the plant-level PI. The Owner also ensures upper level-management is informed. The Data Contact maintains responsibility for collecting and providing data; ensuring data is valid, comprehensive, and accurate; and

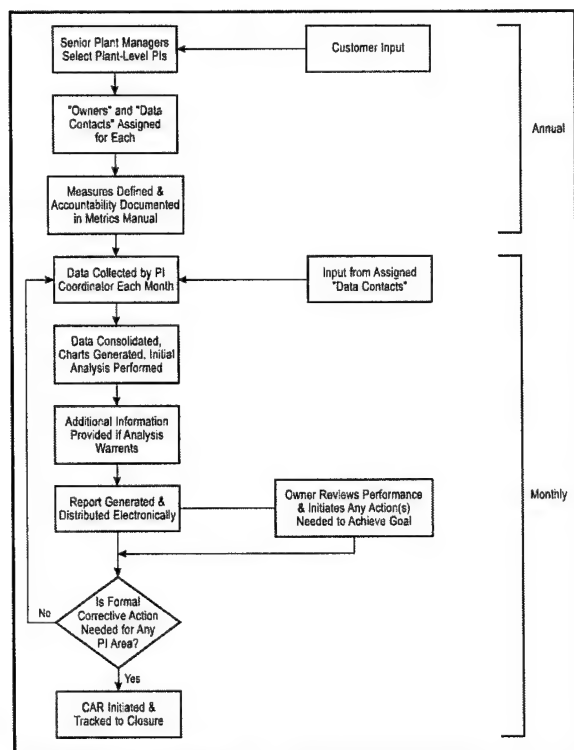


Figure 2-7. Performance Indicator Process

conducting an analysis to observe early trends. PIs are tracked at various levels daily and weekly. Monthly reports encompassing all PIs are generated and distributed electronically.

Each indicator is tied to a specific element of the company's strategic plan. The objective of the indicator is thoroughly defined and clearly explained to ensure that all involved personnel understand each measure is designed to be SMART -- Specific, Measurable, Attainable, Relevant, and Timely.

Target goals for each indicator are specified in ranges on a scale from 0 to 4, and the goals are directly tied to the performance measures of senior managers and directly affect their merit pay. These are flowed down to all levels so that the performance objectives of all plant personnel covered by merit pay are directly tied to specific PIs. This effort is the key to cultural acceptance of the program and has prompted the effective use of PIs for continuous improvement. Application of the program is facilitated by providing employees with training and support at all levels.

Pantex has learned several lessons through this effort. Performance indicators must be used to reflect performance in critical areas, not simply to measure things that are easy to measure. To ensure PIs are meaningful, they are negotiated at several levels prior to acceptance. Measures must be clearly defined and documented and they must be

appropriate for the process or system being measured. Information must be provided in real time if measures are to be used as a management tool. Measures must be accompanied by planning and goal setting. A specific individual must be accountable for the performance being measured in each area and at each level. Teamwork is vital, including the involvement of customers in the measurement process. Senior management must also be involved in the development and use of the measures. Personnel using the measures must be trained properly.

At Pantex, Performance Indicators have been adopted globally as a way of doing business to support continuous improvement through management by fact.

Security Awareness Program

Mason & Hanger - Pantex Security Awareness Program personnel are responsible for translating germane DOE orders into Pantex Plant Standards, and training all plant employees on security awareness tactics. This is accomplished through extensive training of all plant personnel using modern technology such as computer-based training (CBT), through self assessments of the security awareness program, and through monitoring of key performance indicators. In addition to the training provided to plant personnel, the security awareness program also maintains documentation of awareness training, performs self assessments of courses and applicable procedures, and provides valuable interface with the DOE.

The Security Awareness Program currently consists of four briefings -- an Initial Security Awareness Briefing (given to new employees), a Comprehensive Security Awareness Briefing, an Annual Security Refresher Briefing (CBT course given to all employees annually in the month of their birthdays), and a Termination Briefing (given to any employee leaving the payroll). The effectiveness of these courses is enhanced by an attitude that, although the training is required, it does not have to be boring or feared. This attitude is reflected in the enjoyment of participants in the course, the minimization of required testing, and in the fact that there have been no adverse findings in security awareness during the last four audit years. The security awareness program has not undergone intense auditing from DOE for the last two annual periods because of the standard of excellence it had previously demonstrated.

Two key measures of the effectiveness of the training program include the number of employees completing training, and the dollar savings achieved utilizing technology to meet DOE requirements. In September 1995, a typical month, 314 employees received Security Awareness Program training (260 of which received CBT for the annual refresher course). It is also conservatively estimated

that by using CBT refresher training, the Pantex plant realizes \$65K in cost avoidance associated with employee time, instructor time, and materials.

Special Reaction Team Training Program

The highly effective training program for Mason & Hanger - Pantex's Safeguards, Security, and Fire Protection Division's Special Reaction Team (SRT) produces efficiencies in the number of trained personnel, satisfaction of customer requirements, fiscal efficiencies, and technological advantages. The SRT is designed to train the Pantex SRT Special Police Officer III (SPO III) corps, a group comparable to civilian police force SWAT teams, military special operations forces, or other response/recovery organizations. Pantex SRT teams are trained to take the offensive and are required to be continually on site. The requirement for this program is mission-driven and mandated by DOE order.

Prerequisites for entry into the SPO III program require the individual to be SPO II qualified, able to meet the physical requirements, and eligible for job submission when vacancies occur. SRT instructors are required to fulfill extensive certification and maintenance requirements. Pretraining and certification for SRT instructors include basic instructor training, on-the-job training, security police officer instruction certification, and advanced firearms instructor certification. These instructors also must perform routine maintenance training to ensure that skills and capabilities, both physical and educational, are maintained at a high level of expertise and readiness.

Pre-course training provides an introduction into SPO III SRT initial certification and is Pantex-specific. It is conducted on site for two weeks and applies a weapons transition and weapons employment curriculum. When pre-training is completed, candidates enter a four-week SPO III certification course, the first two weeks of which are conducted at Pantex, and the second two weeks at the Safeguard, Security Center Training Academy at Kirtland AFB in New Mexico. The course, taught by Pantex instructors, includes a curriculum with DOE-mandated minimum requirements and Pantex-specific additions.

Pantex has gone beyond DOE requirements for SRT certification and maintenance in several areas. Additional curriculum items and pre-course training, for example, are not required by DOE. The Pantex-specific requirements exceed DOE minimum requirements in the duration of training, and is driven and tailored by site-specific needs assessment, realism, and technology. Pantex has accomplished these additions to the SRT training while accommodating fiscal concerns by working through personnel scheduling measures to reduce overtime costs.

The Pantex SRT won the DOE Secretary's Trophy in 1993 and 1994 and the National SWAT Championship for 1993. One Pantex individual was selected SPO of the Year in 1994. These awards highlight the SRT program's effectiveness and reinforce the affirmation that Pantex has a quality workforce that meets and exceeds the customer's needs and makes maximum use of technology.

Task Order Contracting

Mason & Hanger - Pantex routinely uses task order contracting for flexibility in quickly acquiring a wide variety of services from commercial organizations. Task order contracting was introduced to reduce the vendor base and costs, acquire quality services on time, and improve overall customer service. The principal mechanism in task order contracting is the Task Order Agreement (TOA), a written, unpriced agreement signed by both parties containing a description of services to be provided; methods for pricing, issuing, and delivering future requirements; and terms and conditions that apply to orders placed during the term of the TOA.

Prior to adopting the use of TOAs, Pantex issued individual contracts as specific requirements were identified. Because its contractor base increased significantly in recent years, this practice became inefficient and resulted in lengthy acquisition cycle time and higher administrative costs. Most contracts had to be issued under full, open competition which meant that new contractors without experience or proven performance were continually introduced. A learning curve was necessary with each new contractor, producing frequent, less-than-timely services and unacceptable quality levels.

Task order contracting is used when a significant number of requirements are anticipated but the specific services and prices are not yet defined. Requests for proposal are sent to firms known to Pantex that frequently perform such services. Firms are then "pre-qualified" based on their technical competency and history of competitive pricing. Unpriced TOAs are issued to these firms, signed, and executed prior to release of a specific requirement. When specific requirements are identified, requests for proposal are submitted only to the pre-qualified firms that have been previously selected through the competitive process. Requirements are only issued for specific, well-defined tasks. The proposals are evaluated, and awards for individual releases are made based primarily on past performance of similar projects with cost/price as a significant factor.

Pantex has used task order contracting since 1994. Currently, about \$120M in contracts per year are being issued. Since this practice has been in routine use, the

number of contractors has decreased from 3,800 to 2,500 and the quality of the contractors has increased. Acquisition cycle time has been cut in half from 120 days to 56 and administrative costs have decreased significantly. Pantex has benefited overall from improved performance and quality of services received, and has improved service to its customers. Pre-planning is the key to the success of this method of contracting. TOAs are in place prior to the identification of specific requirements for rapid response time. Whenever requirements can be identified up-

front, task order agreements can be prepared to expedite the acquisition process to achieve lower costs and an increase in the quality of services received.

Training and Development

The employee training program and practices at Mason & Hanger - Pantex have emerged as models for other DOE laboratories. Courses are focused on individual health and safety as they are the plant's top priorities and represent an integral part of Pantex operations. All employees are continually trained to ensure they can perform their work efficiently and safely.

Before 1992, there were no formalized criteria for qualification and certification of the training requirements; job analysis information was virtually non-existent; records were tracked manually; and there were no qualification processes or requirements for instructors. Few administrative controls were in place, allowing training to vary from course to course. There was no technical basis for safety training, and Pantex found themselves in non-compliance with a DOE training order.

Pantex then instituted a comprehensive program toward complying with and exceeding that DOE order. The program benchmarked numerous facilities including the Oak Ridge National Laboratory, Allied Signal, and the Navy Trident Facility to gain insight to already existing materials, programs, and ideas. Plans were developed and implemented based on the results of this study. Oversight for training was centralized and coordinator positions were created in all divisions of Pantex. Performance-based assessment was conducted, a training implementation matrix for executing the DOE training order was created, and personnel with performance-based training experience were hired. Additionally, an outside contractor was retained to assist in conducting job analyses and establishing a job analysis database. Pantex created a Training Records and Certification system and implemented a performance-based process for weapons training. That implementation included hands-on walkdowns of critical safety systems to develop the technical basis for facility-specific safety training courses. Comprehensive training manuals were written and administrative controls were put in place.

Essential to the success of implementing the training program and practices was senior management and union support. Centralized control and documentation were necessary to ensure a standardized approach across all division lines. Benchmarking with other laboratories and companies was very beneficial in shortening the analysis process and avoiding costs.

Because of these efforts, Pantex has not only achieved but exceeded compliance with the DOE training order. It has a comprehensive performance-based training process implemented site-wide, and it is the first DOE site in administrative compliance as well as institutional compliance with the DOE training order. Training qualification and certification data are tracked daily and made available to first-line supervisors through a distributed network. All training is conducted by qualified instructors to the same standards. Over 30 courses are now conducted on CBT hardware. Pantex's Facility Manager Training Program was cited by DOE Field Office in Albuquerque and Los Alamos National Laboratories as an outstanding model to follow. The Facility-Specific Critical Safety Systems Training was recognized by DOE Headquarters, DOE/Albuquerque, and DOE/Amarillo Area Office as the first of its kind. The Programmatic Weapons Training Program won the DOE Secretary's award in 1995.

Work Authorization Control System II

Mason & Hanger - Pantex has developed and implemented a management information system which integrates all requirements for formalized business planning, scheduling, costing, performance measurement, and change control to provide management with real-time decision making information. The Work Authorization Control System II (WACS) has been developed at Pantex since mid-1993 after extensive benchmarking with Boeing, Martin Marietta, and Battelle. A multi-function project team included the chief financial officer, and information services and program management personnel to oversee the development and implementation. The plant General Manager also maintained close involvement.

Prior to WACS, management relied on data from a number of different reports and in many cases, this data was inaccurate, old, not available, and not integrated. As a result, decision making and planning were products of educated guesses and experience. Data could not be correlated among reports in a timely manner. WACS was developed to improve on this process and to provide management with accurate, real-time information.

WACS provides a structured approach to identify, plan, budget, authorize, and status work. It encompasses the total work breakdown structure, planning and budgeting system, performance measurement tools, change control, and authorization. Detailed plans include milestones and

deliverables. WACS most importantly provides management with one common system, yielding a total site plan for operations. Tasks accomplished include work definition, planning and scheduling activities, developing time phased budgets, work authorization, collecting and reporting actual cost, assessing and analyzing performance, formalizing reporting structures, facilitating authorization and execution of change control, and other tasks.

The system continues to evolve. Currently planning data is in the system for the next three years, and contains valuable historical information enabling managers to understand what is happening to their projects and organizations. The system is highly effective in planning and controlling all work and costs because of the total integration of the information with other planning and manage-

ment systems. Users are also taking advantage of system capabilities for predicting and forecasting.

WACS has yielded numerous benefits including on-line user access to planning, budgeting and cost data. All planning is integrated through a site-wide work breakdown structure. Each work package is time phased, resource loaded, and contains measurable deliverables complete with milestones. The system also provides consistent cost estimating and pricing. Many systems have been revised and simplified and old, outmoded systems have been retired. WACS is a structured approach to identify, plan, budget, and authorize workloads; simplify the cost accumulation structure; standardize overhead rates; improve the labor cost collection system; and establish the means for a plant-wide standard labor rate system.

Section 3

Information

Production

Geographical Information System

Mason & Hanger - Pantex has developed an Integrated Environmental Database/Geographical Information System that consolidates all environmental records at the plant site into one centralized location. Graphical representations of analytical data is available to visualize the composition of the geological data in three dimensions.

Originally, data was collected through multiple parties with difficult information exchange between the groups. Four different groups collected data -- M&H/Battelle Pantex, the Army Corps of Engineers, Texas Bureau of Economic Geology, and State Regulatory Agencies. This data was stored in boxes of paper copies along with WordPerfect and Lotus spreadsheet electronic formats. In October 1993, M&H/Battelle Pantex took over all data collection and entered it into a central database located on the plant site. The process resulted in distribution of data across the plant, fast retrieval, and the ability to query based upon regulatory limits or other parameters.

The GIS system displays graphical results and can easily produce sampling maps through database queries. Geological and contamination information can be also produced from this database. Seven other DOE facilities (Savanna River, Los Alamos, Sandia, Pacific Northwest Laboratory/Hanford, Rocky Flats and the Army Corps of Engineers Tulsa District) were investigated along with two on-site systems (Environment, Safety, and Health, and Plant Design). These investigations resulted in a Sybase Database and Intergraph Geographic Information System. The graphical capabilities consist of sampling point maps, profiles, and contouring. Cross sectional displays are also available for in-depth core inspections.

Accurate and easily accessible data can be obtained for use with the M&H/Battelle Integrated Environmental Database/Geographic Information System. Savings in time and money in many areas such as document search, analysis, office space, and duplicating efforts are anticipated.

Facilities

Radiological Assistance Team and Accident Response Group Vehicles

Mason & Hanger - Pantex maintains two teams as part of its response program to radiological or nuclear accidents. To support these critical teams, Pantex has purchased additional vehicles and equipment to ensure that both groups are adequately supplied.

The Radiological Assistance Team represents the Pantex response element for the DOE Radiological Assistance Program (RAP) and assists state, local, and tribal jurisdictions in responding to radiological emergencies. The DOE Accident Response Group (ARG) responds to a peacetime accident involving nuclear weapons or nuclear weapon components. The Pantex ARG is responsible for the packaging of weapons, weapons debris, and radioisotopic thermoelectric generators associated with space launches. The extended Pantex ARG mission also includes the contamination control station for accidents where DOE is the lead agency.

The RAP and ARG shared a single motor home and trailer for command, control, and communications personnel and equipment. The RAP also had a six-passenger pickup truck and a 32-foot enclosed equipment trailer. The vehicles were limited to ground deployment, not well suited to most deployment such as rough terrain or off main roads situations, and contributed to an inefficient emergency response process. Since the vehicles were shared, equipment and materials also could not be pre-loaded.

Consequently, Pantex has procured three vehicles for RAP and two for ARG. All the vehicles are designed to be air transportable and self-sufficient to include on-board generators for power. Radio communications are compatible with the respective programs and on-plant emergency frequencies, and telephone communications are available through either cellular or hard-wired means. They have the capability to transmit telecopies and digital photographs via the telephones. The vehicles are also equipped with global positioning systems, weather data equipment, and hazard prediction modeling equipment.

The RAP and ARG are now independent and can respond simultaneously in the event of accidents. The response is immediate since the vehicles are pre-loaded and ready to deploy. The equipment is designed to meet the needs of the teams for flexible and efficient response.

Subsurface Interface Radar

Subsurface Interface Radar Technology was applied at the Mason & Hanger - Pantex facility when faced with a

need to inspect and map the aging infrastructure and buildings of the facility. This application is used to detect and map reinforcement steel bars in concrete. A high radiation emitting isotopic source, Cobalt 60, was previously used for this purpose. The Cobalt 60's continued use presented a series of problems and disruption to production, as well as prolonged planning which resulted in poor response to requests and continued rising costs.

The initial system used at Pantex was the SIR System-3R which required a 120 volt power source and provided a black and white image display, as well as a printed hard copy of the area inspected. It was capable of providing data on depths up to 24 inches, and with the use of other antenna models, could provide data on inspection depths of several feet.

Pantex now uses Subsurface Interface Radar since this system presents no hazards to personnel and can be used without having to clear the area being mapped. It provides instant results and feedback, and inspections that previously required several days can now be accomplished in the same day. A recent purchase of an SIR System-2 model provides Pantex with a high-performance, portable system that can be used by one person and carried into remote areas. This system uses a 12 volt battery pack and provides a digital control unit with an internal hard drive and color video display. Acquired data can be transferred to any IBM-compatible PC, and hard copies of the data can be produced using a printer.

Recent applications of this system include inspections at Los Alamos National Laboratory for hot cell earthquake protection upgrades, Pantex security systems upgrades, and continued use in the location of rebar in the concrete floors and walls throughout the facility for the installation of new equipment. Other applications that may be applied in the future include the location of underground utilities and storage tanks, locating and plotting hazardous waste dumps, and locating buried objects at accident sites.

Utility Systems Reliability

Mason & Hanger - Pantex's Utility System Reliability performance measurement system reduces utility downtime by improving the planning and scheduling of operations and maintenance of utility systems for maximum productive performance. System performance is measured by the development of an assessment system that tracks the utility systems' reliability. Current data is being collected for a baseline measurement. The system should be capable of monitoring improvements in the years to come.

The performance rating system will be used for baseline measurements and rates the uptime from 0 to 4, with 4 representing uptimes greater than 99.966%, a rating of 3

representing uptimes greater than 99.932%, a rating of 2 representing uptimes greater than 99.863 %, a rating of 1 representing uptimes greater than 99.772%, and any uptimes less than 99.722% are a 0 rating.

There are two significant reasons that this system shows early signs of improving the utility systems' reliability. Personnel are now measured on response capability which presents a goal set each year and instills pride in improvements. Also, problems are receiving higher priority. This system represents a significant move in the right direction and could establish a trend in utility management that improves the industrial utility reliability.

Management

Accounts Payable

The Mason & Hanger - Pantex Accounting Department has successfully applied continuous improvement principles to improve the productivity of its accounts payable process. Almost 3,000 invoices per month -- 36,000 yearly -- are processed at the plant, with 80% of the payments being regular invoices and the remainder for freight, special check requests, manual checks, transportation, and credit cards.

Before 1993, the average time period for outstanding payments was 46 days, with an average of 190 invoices 30 days past due and 280 invoices 60 days past due. Terms of contracts required payment within 30 days after receipt of material or services. Vendor relations were adversely affected, accounting department personnel were continuously frustrated, and processes that matched receipt of materials and services with invoices and orders were cumbersome, inaccurate, and slow.

Steps were consequently taken to improve accounts payable productivity. The basic principles of continuous improvement such as teaming concepts, problem identification, action plan development, employee empowerment, performance indicators development, communication enhancement, and management support were aggressively applied. Key problems that were identified included the number of forms and paperwork in the system, the number of unnecessary approvals and sign-offs required, and the lack of efficient and effective communication. The Accounting department reevaluated the accounts payable process and combined all forms into one, took ownership of the approval process, and improved communications through the site's e-mail system.

The Accounting Department has subsequently reduced the average age of outstanding accounts payable from 46 days to 20 days -- a 55% reduction. The average number of past due invoices for more than 30 days has been reduced

from 280 to 35, and past due invoices over 60 days have been reduced from 180 to 11. A 27% reduction in workforce was also realized.

Breathing Zone Monitoring

Battelle - Pantex modified a procedure in 1994 to monitor the workplace for airborne radioactive materials. This change in procedure allowed dosimetry personnel to respond more quickly to potentially undesirable readings. Pantex relied heavily on stationary, continuous air monitors based on ill-defined and expensive bioassay programs. Thorium and plutonium bioassay programs were unable to detect doses below 100 mrem Committed Effective Dose Equivalent -- in effect, workers could be exposed to low dosages that might go undetected.

Breathing zone monitors are now provided to all personnel entering contamination or airborne radiation areas. The breathing zone monitor consists of a pump that attaches to the worker's belt and a flexible hose that is attached to a filter cartridge. The filter cartridge is placed in the breathing zone of the individual. These filters are counted within 48 hours after collection on a low background proportional counter. Plutonium levels as low as 0.43 mrem can now be detected. If filters are over 0.1 Derived Air Concentration (DAC), a special bioassay program, is considered for the individual.

Pantex dosimetry personnel can now respond rapidly to positive filters, and follow-up bioassay analysis increases the odds of detecting doses from plutonium or thorium below 100 mrem. In addition, dose assessment may be performed using an air-based dose assessment procedure if bioassay data is deemed unreliable; bioassay monitoring can be pinpointed to the point of intake; there is a reduction in the number of personnel on the routine bioassay program due to characterization with breathing zone filters and corresponding reduction in cost; there is early warning of potential airborne problems in the workplace; and early internal dose estimates are now possible.

Some of the lessons learned from this change are that the trigger of 0.1 DAC is not a proper indication of intake. The Dosimetry Section of Pantex advocates using 8 DAC-hours as a trigger since 0.1 DAC is not a proper indication of intake. Short sample times can result in questionable DAC calculations (in these cases one particle can result in a high DAC value since DAC is dependent on air flow rate). Also, breathing zone monitor filters and Continuous Air Monitoring filter results cannot be correlated due to their location.

Classified Matter Protection and Control Program

The Classified Matter Protection and Control (CMPC)

Program maintains four critical objectives at the Mason & Hanger - Pantex plant by providing training tracked through a central training database and reminding employees through printed and electronic means of CMPC matters. These four objectives for CMPC include:

- training and certifying classified matter custodians and representatives at the Pantex plant,
- leading selfassessments of areas which handle classified matter as a requirement of their job scope,
- performing conduct-of-operations assessments to ensure compliance with applicable regulations, and
- maintaining an interface with the DOE headquarters.

Areas handling classified matter as a routine part of the job -- such as graphics organizations and mail rooms -- undergo self-assessment each month. These self assessments are coordinated with the Safeguards, Security and Fire Protection Division. In addition, all Pantex document custodians are surveyed annually.

The CMPC program is critically important at the Pantex plant. The plant currently has over 500,000 classified documents assigned to employees, more than 150,000 classified components, and approximately 1,000 custodians/representatives responsible for classified matter. Also, the average number of classified document surveys performed in FY-95 was 170 per month, and the corresponding number for FY-96 (through April) is 1,038 per month, a more than six-fold increase in the number of surveys performed.

Communications Security Material Records System

As the result of two events, Mason & Hanger - Pantex upgraded its manual, hard-copy Communications Material Records (CMR) system to facilitate locally maintaining accountability of crypto materials, cryptographic equipment, controlled cryptographic items, and other Communications Security (COMSEC) materials. In mid-1990, the Defense Nuclear Agency appointed Pantex the historical repository for all old cryptographic materials. The Agency also began a number of changes which resulted in a significant increase in the volume of materials tracked, and Pantex's inventory of 250 items quickly grew to 1,300 items. Consequently, Pantex migrated its system to the current PC-based application and database.

The COMSEC is designed to provide required information to the local COMSEC Account Custodian in accordance with the DOE COMSEC Procedural Guide. This standalone system also supports document and report preparation.

The pre-1991 CMR system stored all COMSEC materials data on a typed (or handwritten) index card. Each card

contained only eight items of data and all were stored in an index file. When material was destroyed, transferred to another COMSEC account, or temporarily transferred to an individual, the corresponding CMR card would have to be extracted and manually updated. Additional monthly reports had to be typed and sent to the DOE COMSEC office of record to ensure accounting information was maintained.

The current CMR system operates on an IBM Personal System 2 model 80 (4 megabytes RAM) with an 80-megabyte hard drive, and a Hewlett-Packard Laser Jet II printer. The operating system is IBM DOS 4.01 and the application is written in Nantucket's Clipper 5.87. The CMR system has been implemented on a variety of workstations at other locations as a result of providing the software to other DOE sites when requested. Key functions performed by the CMR system include local tailoring, data entry/copy/edit, user prompting, inventory management, forms creation, retrieval by key information, and effective archive/backup.

Benefits derived from use of the computerized CMR system over the index card system include a 75% reduction in labor requirements, more flexible information retrieval, enhanced reporting capabilities, and more effective management of large volumes of data.

Document Management Program

The Mason & Hanger - Pantex document management program for managing active, controlled operating documents encompasses document indexing and revision control, document change control, and access and distribution of documents. These modules are part of the company's integrated information management system. The document management function is administered by six full time employees. Document control coordinators within each division work with the document management personnel to facilitate document management throughout the entire Pantex facility.

Document indexing and revision control is a module of the company's PassPort information management system. It provides cross-referencing to other documents, systems, and equipment that may be affected by the base document, and user-defined fields such as badge numbers and projects that may be impacted by the base document.

A new component of the system is the Document Change Control module of PassPort, an action tracking system which identifies and captures change requests to documents. For any proposed change, the system identifies other documents that will be affected by the change. The system identifies the level of change such as safety or compliance and initiates electronic routing and approval

using an approval matrix based on the document type and level of change. Upon completion of routing and approval, the system incorporates the changes and issues new revisions electronically. This module is currently being implemented.

The access and distribution module of PassPort electronically handles distribution lists, controlled copies, and document check out/in. Documents currently in the system include internal documents, reference documents, directives, procedures, lessons learned, and training documents. The system has a powerful research tool called ZyINDEX for a full text search and retrieval capability. It provides network access to an electronic document library, network access to reference material on CDs, and use of Internet and Intranet to search for regulatory and standards data and other information.

Electronic Purchasing System

The Mason & Hanger - Pantex Financial Inventory Procurement System (FIPS) electronically processes material and services purchases using Computer Associates CAS 1.3 software and an IBM mainframe. In place since 1992, the system has enhanced all aspects of the procurement process from the time of demand to the completion of payment, resulting in a reduced acquisition cycle, improved process accuracy, full traceability, and paper reduction.

The previous purchasing process lacked control and visibility. Handwritten paper requisitions were routed through the plant mail for as many as six approvals. Purchase orders were then typed and mailed out. Problems encountered included a lengthy cycle time for printing and copying requisitions, and distribution to all approvers. Requisitions were often lost and again reprinted and rerouted for approval. There were no means for parallel routing to save time. The status of a requisition was not readily available until it reached its destination in the Procurement Office.

After benchmarking with other activities and careful analysis of the options, Pantex developed and implemented a pilot electronic system that utilized the FIPS and the CAS 1.3, successfully leading Pantex to bringing the Electronic Purchasing System on-line in April 1992. All processes that were performed manually were accomplished electronically.

The system provides serial and parallel routing capabilities with an unlimited number of approvers, and same-day approval is achievable. The system provides status of all requisitions, purchase orders, and deliveries, and has comprehensive security, software, and audit controls in place. Computer security ensures that users have access only to

authorized portions of the software which is easily programmed for proper approval authority. There are comprehensive audit trails for all transactions.

Lessons learned through the development and implementation of the system include:

- that a significant learning curve was experienced by the managers participating in the approval process;
- a perception that the system was not user friendly until the user became familiar;
- just-in-time training was needed to avoid training too early;
- training needed to be tailored to specific groups; and,
- a pilot program was essential to fully analyze and meet program criteria.

FIPS has improved visibility, integrity, and cycle time. Full tracking of requisitions, identifications of bottlenecks, and status from creation through procurement can be accomplished at minimal cost to the user. The system allows easier enforcement of standards and provides traceability for audits. The system accommodates 15,000 requisitions processed each year from 800 requestors without loss, and approval is performed only once. Paper files have been reduced by at least 50%. Cycle time for getting a requisition through procurement has been reduced substantially.

Emergency Operations Center

The Mason & Hanger - Pantex Emergency Operations Center (EOC) facilities are being upgraded to overcome several limitations such as inadequate space, no life support habitability, no long-term operability, and a cumbersome reference library. This upgrade was in response to the need for a fully-operational, highly-capable EOC that is critical to provide immediate, coordinated, plant-wide emergency response.

The new EOC is scheduled for operation in October 1996 and will include a wide range of advanced processes, equipment, and software to significantly enhance the EOC's ability to respond to a plant-wide emergency quickly, efficiently, and appropriately. The newly-constructed EOC will provide large operating space and floor plans to accommodate emergency response teams and decision-makers in a secure, safe environment. Measures are in place to ensure and maintain habitability 24 hours a day over a long term. The EOC is an HEPA-filtered, over-pressured building which is both blast- and tornado-resistant. It has complete decontamination and medical treatment facilities and has been equipped with a fully electronic reference library and information and display features including video switch capability. It also has EOC, plant, and headquarters LAN, radio, telephone and media

communications with secure operating features when required. It has an emergency press center to handle media inquiries.

New equipment will also allow the EOC to achieve a high state of readiness and response capability. This equipment includes clocks with local, Zulu, deadline and elapsed features; access control with a closed circuit monitor and remote lock releases; an alarm annunciator panel with lightning/static warning; building pressure alarms; HEPA, carbon and pre-filtered alarms; a decontamination facility exhaust; and a radiation alarms monitoring system.

All advanced technologies and measures Pantex is taking to upgrade its EOC will allow it to reduce its Emergency Response Organization membership by 10% and streamline operations, which it will be able to more definitively quantify when it conducts an EOC facility prove-out in the fall of 1996. High technology tools for electronic management of information, communication, display, media and reference material will contribute to improved morale of the emergency response personnel, operational efficiency and effectiveness for emergency response at Pantex.

Labor Relations

Since 1988, Mason & Hanger - Pantex has experienced gradual, continuing improvement in labor-management relationships marked by decreased grievance and arbitration activity, improvement in operational efficiencies, increased employee involvement, and better communications. Most Pantex hourly employees are represented by the Metal Trades Council, an umbrella organization comprised of 12 local unions for approximately 1,200 workers.

Pantex management and the Metal Trades Council have developed a cooperative philosophy over the years (Figure 3-1). By 1991, union and company representatives were attending annual seminars focused on union and management cooperation. The first joint union-management

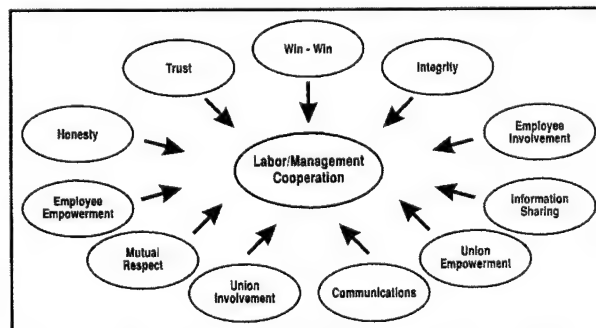


Figure 3-1. Metal Trades Council - M&H Cooperative Philosophy

departmental process improvement team was formed in 1991, followed in 1992 by the establishment of pre-negotiation, problem-solving teams. These teams worked to identify and share major issues for the 1993 bargaining session a year in advance of negotiations. The joint problem-solving teams were comprised of company and union negotiating committee members. They provided an opportunity for the committees to interact prior to the negotiations for the purposes of information sharing, education, and problem area prioritization to identify the best mutually acceptable solutions. The results were improved communications and fewer surprises during the negotiation process. The tone had been set for negotiations to be conducted in a constructive manner rather than a confrontational one. Major issues such as changes in job classifications, health insurance, job evaluations, testing, job qualifications, retirement, and overtime were resolved to the satisfaction of both sides quickly and amicably.

Problem-solving teams were again utilized in 1995 in advance of the scheduled 1996 negotiations. Eight teams were established to address issues including training requirements, insurance and pension plans, sick leave, work schedules and overtime, job upgrades, wage structure, subcontracting, and award fee incentives. All issues were addressed cooperatively by both union and management. A zero net cost, two-year agreement was reached seven weeks before the expiration of the old contract.

The union and management cooperative effort to communicate on major issues well in advance of contract negotiations has opened up a new era of partnership resulting in improved quality of work life and improvements in the efficiency of operations. Better communication has improved problem solving by looking at issues from the perspective of both management and labor. The effects have been enhanced job security and employee financial security with increased willingness to address problems.

Recognition of the union as a partner gives management an advocate that can communicate with the workers at a level that management cannot. It gives the union a voice in operations and places responsibility for the success of operations on both the company and the union. Other benefits include enhanced customer satisfaction and improved ability to focus on the Pantex mission. Since adopting the philosophy of labor-management cooperation, grievance activity has declined 34% and arbitration activity has declined 88%. The new approach has improved the safety and health environment for workers, helped to guarantee the retention of current work, and enhanced the company's competitive position for new work.

Metrology Calibration Quality Control System

Mason & Hanger - Pantex is developing a Metrology Calibration Quality Control System to help the division manage the calibration cycles and ratios of all calibrated items used at the facility. Management and tracking of 7,000 to 8,000 items that require periodic recall and calibration are currently conducted using an old system developed in the 1960s. This system is inflexible, outdated, and relies on manual inputs, making it time-intensive and error-prone.

Recognizing the shortcomings of this system, the Metrology Department has obtained a calibration management system from Norfox Software Inc., Seattle, WA to provide the necessary tracking and recall of the items requiring calibration. This new system does not, however, provide the required level of accuracy; therefore, Pantex has developed a Calibration Quality Control Database (CQCD) in house.

CQCD, when complete, will contain the current specifications for the calibration document required for each item under calibration. It will facilitate data manipulation, on-line access to current specifications, and suggested end-use standards by document and or item ID number. It will also generate timely quality reports and consistent calculations for the calibration ratios with built-in unit conversions. The database is being developed to function in conjunction with the Norfox calibration system and provide on-line recall notification for all items requiring calibration.

The Metrology Department personnel who are developing CQCD estimate 75% of the work required has been completed with an estimated completion date of August 1996. This new system will provide M&H Pantex with a high-quality calibration management system that allows for user access on-line for current, quick, and accurate updates. It will also allow for automatically generated calibration reports and provide consistent directions and controls within the calibration process.

Neutron Dose Calculation Method

Battelle - Pantex plant personnel developed a neutron dose calculation method to correct a number of undesirable factors. Prior to 1994, neutron correction factors were based on conservative values that overestimated the neutron dose by a factor of 3 to 5. Since May 1994, measures have been put in place to provide accurate neutron dose values to the work force, determine Pantex plant site-specific neutron correction factors, and upgrade the neutron dose monitoring program. This is being pursued while

implementing a technically sound program that provides valid information for various weapon programs.

The new process includes a model that does not require information on the radiation environment but does provide more realistic neutron doses, additional radiation characterization data, and an algorithm that gives accurate neutron dose results for the plant and for the DOE Laboratory Accreditation Program fields. The model was generated from test data using Cf-252 with moderation from 0 CM to 5.9 CM of Lucite (PMMA), and the response of the UD809/UD812 dosimeters and Tissue Equivalent Proportional Counters output. The model was field tested by measuring six weapon programs in the same manner as the moderated Cf-252 exposures. The experimental data was proven to fit within 10% of the field data (worst case field data was 30%).

Lessons learned by Radiation Safety Department Dosimetry Section personnel include a number of findings such as:

- long count times are required to perform neutron measurements at one meter for weapons programs;
- the position of TLDs on the phantom did not affect overall performance of the experiments;
- pits have significant x-ray radiation fields which result in the saturation of element 3 on the UD-812 dosimeter (this dosimeter cannot be annealed down for issue and is thus taken out of service);
- less than 20 dosimeters can be used to obtain reliable results;
- neutron doses are not a significant problem at the Pantex plant (neutron doses are less than 1% of the total deep dose); and,
- standardized test protocol is required to obtain reliable results.

The process change has allowed Pantex to obtain additional radiation characterization data for various weapon programs. This data is currently being used by National Laboratories and Radiation Safety. Pantex has also determined that information is not required regarding the radiation environment in which the worker was exposed. This allows the worker flexibility to move from work place to work place with the same dosimeter, as work area-specific correction factors are not needed.

Property Accountability

The property accountability system employed at Mason & Hanger - Pantex has the capability to track sensitive personal property throughout their life cycles. Personal properties with a unit acquisition cost of \$200 or more are defined as sensitive items and are entered into M&H's FIPS. These items are assigned and tagged with a bar code

and are tracked throughout the life cycle. To ensure the accuracy of inventory records, an annual audit to validate the location of all sensitive property is performed. M&H's system has an inventory accuracy rate of 99.5%.

There are integrated areas that directly contribute to Mason & Hanger's high inventory accuracy rate.

1. Property Control personnel are assigned tagging, tracking, database maintenance, repairs, government-furnished property, and loans. Property Location Custodians (PLCs) are assigned responsibility for property within close proximity of their assigned work areas. The procurement department will not issue a Purchase Order for new property unless a PLC for the new property has been assigned. The PLC is responsible for his assigned property until the PLC is transferred to a new job or the property is moved to another location, at that time a new PLC is assigned. A database is maintained for all property with information that includes the PLC, property location, type, value, as well as other information. The custodians support the property control department in the annual inventory and are instrumental in the high accuracy rate of M&H's property accountability system.
2. Property Protection personnel encompass property passes, security, vehicle searches, and limiting building access.
3. Property Disposal personnel handle excess property, surplus, retirements, transfers, sales, and donations.

Property that has been determined to be excess by M&H is given to local schools. This practice has allowed M&H to maintain an inventory that serves the best interest of the company and local community.

Quality Assurance Program

Mason & Hanger - Pantex has integrated a Quality Assurance Program into its management system as an employee-owned process. The traditional program maintained separate quality functions for each department, performed after completion of work tasks. In 1990, the company consolidated external requirements into policy directives that cross division lines and integrate specific functional areas of quality.

The Quality Division previously employed 17% of the total workforce to perform quality assurance functions. Today, the Quality Division has decreased to 2% while establishing a cultural change through which the employee is ultimately responsible for producing a quality product. This empowerment by the Quality Assurance Program to line organizations has created opportunities for employees to identify areas for improvements. By identifying functional areas, Pantex was able to align requirements and

objectives that are applicable to these areas, from multiple external governing documents. The 12 functional areas comprise the Quality Assurance Program at Pantex.

The benefits of implementing this program are numerous. The program enhances Pantex's ability to meet or exceed customer requirements and/or expectations while reducing non-productive employee time, reduce operating costs, and create a single program although there are multiple governing documents.

Empowering its personnel to assume quality assurance responsibilities, M&H - Pantex maintains consistency across divisions through a single quality program, while line organization quality assurance efforts support employee ownership of quality products.

Radiological Monitoring System Maintenance Training

Mason & Hanger - Pantex has instituted a unique training program for its maintenance personnel. The Radiation Alarm Monitoring System (RAMS), initiated in 1994, ensures consistent and accurate testing and maintenance of various control systems used throughout the facility. In-house maintenance personnel have designed and built a working model of these systems, using actual system components and specifications. These models allow maintenance personnel to receive hands-on training on all systems in a controlled classroom setting. A variety of situations and conditions can be simulated without disruption to production or incurring costs associated with training on the shop floor.

The training program was developed by journeymen-level personnel with hands-on experience and site-specific knowledge of the various systems. These personnel have developed a training system that interfaces with five additional critical systems by combining current procedural controls with the actual operating equipment. Systems included are fire systems, blast door interlocks, air handling units, the high efficiency particulate air filter system, and blast valves.

Ultimately, safety is the most important factor at Pantex for on-site personnel and the general public. Pantex has established a highly useful process based on thorough research of technical and design requirements including safety criteria by ensuring consistent and accurate testing of the monitoring systems while maximizing their useful life.

Review of Bioassay Data Analyzed Off Site

Battelle - Pantex generated an internal operating procedure in 1995 to effectively monitor bioassay analyses

performed by off-site vendors. This program was established in response to DOE concerns about the analyses results, the need to establish quality assurance and control methods, and establish a level of confidence with the off-site analytical laboratories. A revised statement of work was also negotiated with these off-site laboratories.

An effective monitoring plan for bioassay analysis performed by off-site vendors was not in effect at the Pantex plant before 1995, and bioassay data submitted by the vendors was taken at face value with no quality checks performed in-house. Pantex found that blind audit and blank samples were not being sent to off-site analytical laboratories, and the quality of off-site laboratories was suspect.

Under the revised procedure and statement of work, bioassay data validity is tested by reviewing yield/percent recovery, cross contamination indicators, quality control spikes, accuracy and precision and adherence to the contractual minimum detectable activity. An intercomparison program is also maintained through the Oak Ridge National Laboratories for thorium, uranium, plutonium, and tritium. If any test fails, follow-up actions are taken to identify and resolve the problem.

The benefits of this monitoring plan and revised SOW ensures a standardized review process for bioassay data, establishes rejection and acceptance criteria for bioassay data, ensures a timely review of bioassay data and identification of positive bioassay results, establishes controls over the bioassay laboratories, helps Pantex obtain confidence in its bioassay laboratories, and aids in early detection of problems.

Safeguards and Security Self-Assessment Program

The Mason & Hanger - Pantex Safeguards, Security and Fire Protection Division of the plant utilizes a comprehensive program to validate the Site Safeguards and Security Plan (SSSP), and to establish a baseline against which to evaluate continuous improvements. This is accomplished primarily by developing, performing, and evaluating assessments based on the recommendations of subject matter experts as well as department-specific performance objectives.

The initial Pantex Plant Safeguards and Security Self-Assessment Program was begun in 1992. In that initial program, self-assessments had less emphasis on content and were procedure-oriented rather than process-oriented. Other disadvantages of that system included the limited program structure, unclear objectives, and minimal independent review and coordination. While the program begun in 1992 met the DOE requirements for a self-

assessment program, a new system was needed which would provide a closed-loop system, place more emphasis on content rather than procedure, and provide adequate documentation.

The current Pantex plant Safeguards and Security Self-Assessment Program, which was initiated in 1994, is based on the SSSP and involves assessments performed by subject matter experts. (An independent self-assessment is performed by the Safeguards, Security, and Fire Protection Division when requested.) The current program also allows evaluation of the self-assessment plan by appropriate managers, ensures complete testing, minimizes redundant training, and incorporates training review.

Benefits derived from the system include savings associated with the elimination of redundant testing, benefits associated with complete documentation, and also benefits associated with a more reliable, closed-loop, consistent and uniform assessment process.

Security Force Training

The Mason & Hanger - Pantex plant maintains a large security staff that meets or exceeds its customer's needs, trains only what is necessary, makes maximum use of technology during the training process, and is a recognized quality workforce. This staff is responsible for protecting DOE interests from theft or diversion of special nuclear material, sabotage, espionage, loss or theft of classified matter, loss or theft of government property, and other hostile acts that may adversely affect national security or health and safety. The Safeguards, Security & Fire Protection Division (SSFD) is charged with providing graded, cost-effective protection in accordance with a specific Site Safeguard Security Plan. Within the SSFD, the Security Technology and Planning department conducts security planning analysis, and implementation of advanced technology applications for the safeguards and security program. The Security Force department consists of the Protective Force branch and Operations Plans and Training branch, and is responsible for the actual plant security, and operations plans and training of all security personnel. The security force is divided into four groups which work four days on and four days off, and one group of special days and cadre personnel which work vacation, training, sick and unexpected absence days for the regular security personnel.

Mandatory skills training and recertification training for this diverse work force presents a challenge for the training personnel. Pantex has a goal of zero overtime hours for personnel due to training requirements. Mandatory training of Security Police Officers II requires eight days of annual training, and Security Police Officers III receive

17 days of training yearly. This training consists of instructional systems that are design-driven based on assessed needs. Resources used include classrooms, shooting ranges, a shoothouse, bays and cells, a physical fitness facility, computer-based training, interactive television, and engagement simulation systems. The facility is the first DOE order 5630.15 safeguards and security approved program. Pantex maintains approved police officer instructor certification, firearms instructor certification, advanced firearms instructor certification and chemical agent instructor status for its training personnel.

Small Purchase Order Credit Card System

Mason & Hanger - Pantex produced a significant reduction in processing small purchase orders through the use of a small purchase order credit card system. An analysis of Pantex's procurement system revealed that over 75% of all purchases were less than \$2.5K with an average cycle time of 53 hours per purchase. An evaluation of the small purchase order system also indicated that the current system did not meet company/employee needs.

To reduce costs and improve customer satisfaction, a system had to be implemented to simplify the procurement process, improve productivity, and enhance internal controls. Consequently, Pantex started a small purchase order card system to allow purchases of less than \$2.5K to be procured through the use of credit cards issued to specific employees within each work center.

The credit card system has allowed personnel to purchase products that meet their needs and serve the best interest of the company. In addition, the use of credit cards has reduced procurement delay time, and improved the account payable system by reducing the procurement labor for small purchases from 53 hours to 19 hours per purchase.

Socioeconomic Purchase Program

The socioeconomic purchase program at Mason & Hanger - Pantex promotes small businesses, small disadvantaged businesses, minority businesses, and women-owned businesses. This program employs a subcontracting specialist to review proposed purchase requirements and contact local communities to determine if residing small businesses are available and capable of meeting the terms of the requirements. As a result, Pantex awarded 70% of its commercial procurements to small businesses in FY95.

The socioeconomic program has enabled Mason & Hanger - Pantex to demonstrate leadership in the small business community. As such, Pantex provides capable small businesses the tools and guidance that are needed for small businesses to succeed.

The practice of using socioeconomic purchases has yielded positive recognition to Mason & Hanger - Pantex locally and nationally. For example, Mason & Hanger was presented a 1995 Crystal Award, presented every three years to Federal Government prime contractors that demonstrate exceptional use of small businesses.

Standardized Hardware and Software

Mason & Hanger - Pantex standardized its hardware and software computer systems and applicable networks to meet the needs of network integration, information sharing, and cost containment. A self evaluation of the work centers throughout the plant in 1994 revealed that many work centers contained standalone personal computers based on individual preference, and there were numerous isolated networks. This practice was costly and resulted in islands of information that were not compatible with other departments. Information could therefore not be shared in a timely manner.

To reduce costs and to incorporate a standalone network system within the company, Pantex developed a standardized list of software and hardware that limited what could be used or purchased. Pantex also set up a department to supervise the effectiveness and efficiency of the system by monitoring and tracking such indicators as system availability (uptime and downtime), and calls received by the help desk. To enhance communications with customers/users, a service-level agreement which defines the software and hardware selection process is discussed and signed by applicable work center managers.

These practices have greatly improved Pantex's policy to reduce costs and standardize the company's electronic network. Lessons learned include that customers/users must be involved in the standards selection process, and a cost effective system must be responsive to today's environment of new technology. The company has demonstrated improvements in data sharing capabilities and reduction in costs. As a result, M&H's highway of information is available 99.6% of the time to all applicable work centers in a timely manner through short and long-range planning.

Vital Records Protection Program

The Mason & Hanger - Pantex plant is implementing a formalized program to protect all company vital records from loss due to accident, fire, flood, and sabotage by

placing them on microfilm formats. Vital records comprise approximately 10% of the total company records and include personnel, facility drawings, and radiation dosimeter readings that are essential to continue the company's operations, would help recreate the company's legal and financial position, and help preserve the rights and interests of the company. The program is designed to protect integrity, ensure retrievability throughout their retention period, provide a stable medium, and be cost effective.

The vital records protection issue was not actively addressed before 1992. Protection/maintenance of vital records was fragmented, decentralized, informal, and usually inadequately identified. Records were predominately paper forms, documents, and drawings; stored in cabinets, boxes, and folders; and located in remote sites throughout the Pantex plant. In 1992, the EOC at Pantex began a comprehensive Vital Records Protection Program in response to DOE. The program outline called for determining what vital records existed, identification of where vital records were located, centralized management of vital records, and compliance with Federal regulations. Six records management personnel were assigned to the program. During 1992-1993, a physical inventory was taken of all records for a baseline. In 1993, the records management infrastructure established Division Records Officers and Record Custodians. Interviews were conducted with management to determine the value of record listings, and questionnaires were completed by the Record Custodians. The records were researched and analyzed, followed by the generation and publication of a Vital Records Protection Program standard. Microfilm formats consist of roll film (for facility design project files and weapon records), microfiche (for radiation dosimeter and medical case files), and aperture cards (for facility drawings). The program maintains the master microfilms in a temperature and humidity-controlled vault to provide medium stability, and can provide duplication and dispersal throughout the plant.

As of May 1996, the program has transferred over 60,000 vital records to microfilm. All vital records have been identified and moved to a centralized location to continue the microfilming process. An estimated 98% reduction in storage requirements is anticipated through the microfilming process. Future plans include capturing information at the point of creation, making information more assessable to users, and eventually digitizing the filmed image of records requiring high occurrence of retrieval.

Appendix A

Table of Acronyms

Acronym	Definition
ARG	Accident Response Group
BMP	Best Manufacturing Practices
CAS	Computer Associates
CBT	Computer-based Training
COMSEC	Communications Security
CMPC	Classified Matter Protection and Control
CQCD	Calibration Quality Control Database
DAC	Derived Air Concentration
DOE	Department of Energy
EIS	Environmental Impact Statement
EOC	Emergency Operations Center
FIPS	Financial Inventory Procurement System
HE	High Explosive
ISP	Integrated Site Planning
M&H	Mason & Hanger Corporation
P2	Pollution Prevention
PI	Performance Indicator
PLC	Property Location Custodian
PPOA	Pollution Prevention Opportunity Assessment
RAP	Radiological Assistance Program
SPO	Security Police Officer
SRT	Special Reaction Team
SSFD	Safeguards, Security & Fire Protection Division
SSSP	Site Safeguards and Security Plan
TOA	Task Order Agreement
WACS	Work Authorization Control System

Appendix B

BMP Survey Team

Team Member	Activity	Function
Larry Robertson (812) 854-5336	Crane Division Naval Surface Warfare Center Crane, IN	Team Chairman
Amy Scanlan (301) 403-8100	BMP Center of Excellence College Park, MD	Technical Writer

Security/Environmental Safety and Health Team

Don Hill (317) 306-3781	Naval Air Warfare Center Aircraft Division Indianapolis, IN	Team Leader
Terry Payne (423) 574-0008	Oak Ridge National Laboratories Oak Ridge, TN	
Anne Marie SuPrise (301) 403-8100	BMP Center of Excellence College Park, MD	

Management/Logistics Team

Rick Purcell (301) 403-8100	BMP Center of Excellence College Park, MD	Team Leader
Larry Halbig (317) 306-3781	Naval Air Warfare Center Aircraft Division Indianapolis, IN	
Duane Maddock (909) 273-4617	Naval Warfare Assessment Division Corona, CA	

Production/Facilities Team

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Team Leader

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BMP Representative
Vallejo, CA

Nancy Gillenwater
(812) 854-1478

Crane Division
Naval Surface Warfare Center
Crane, IN

Appendix C

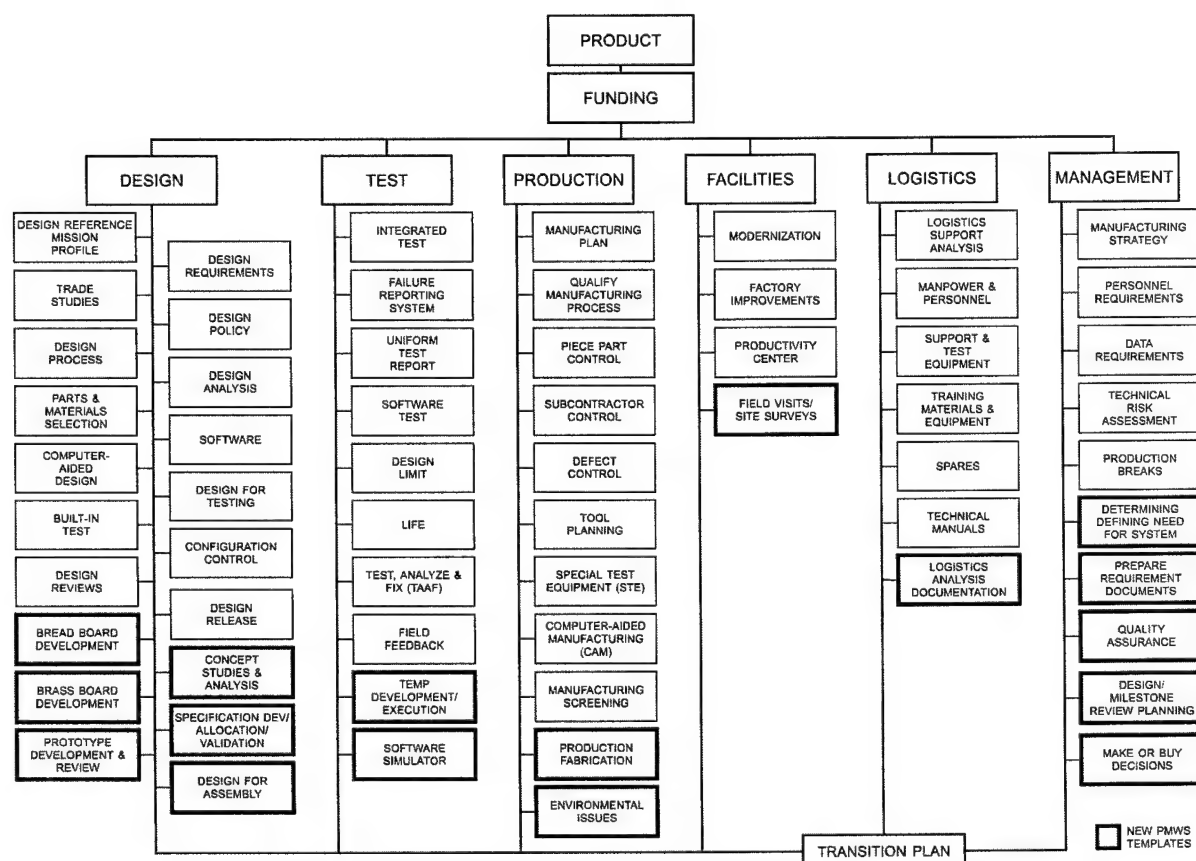
Critical Path Templates and BMP Templates

This survey was structured around and concentrated on the functional areas of design, test, production, facilities, logistics, and management as presented in the Department of Defense 4245.7-M, *Transition from Development to Production* document. This publication defines the proper tools—or templates—that constitute the critical path for a successful material acquisition program. It describes techniques for improving the acquisition process by addressing

it as an *industrial* process that focuses on the product's design, test, and production phases which are interrelated and interdependent disciplines.

The BMP program has continued to build on this knowledge base by developing 17 new templates that complement the existing DOD 4245.7-M templates. These BMP templates address new or emerging technologies and processes.

“CRITICAL PATH TEMPLATES FOR TRANSITION FROM DEVELOPMENT TO PRODUCTION”



Appendix D

BMPnet and the Program Manager's WorkStation

The Program Manager's WorkStation (PMWS) is a series of interrelated software environments and knowledge-based packages that provides timely acquisition and engineering information to the user. This WorkStation is hosted on the BMPnet that supports communication nationwide to promote technology transfer and continuous improvement. Access to BMPnet is through modem dial-in, free PMWS software, Internet, World Wide Web, or CD-ROM. Besides PMWS, BMPnet features include communication by electronic mail and file transfer; access to Special Interest Groups on more than 75 topics including producibility and Government specifications; information upload and download capability; and the ability to download BMPnet-resident programs.

KnowHow is an intelligent, automated method that turns "Handbooks" into expert systems or digitized text. It provides rapid access to information through an intelligent search capability that gets information users need on the screen in less than three minutes. That critical information is in handbooks including Acquisition Streamlining, Non-Development Items, Value Engineering, NAVSOP-6071 (Best Practices Manual), MIL-STD-2167/2168 and the DoD 5000 series documents.

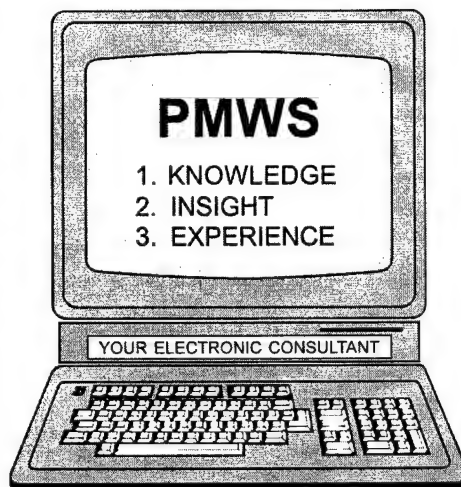
The Technical Risk Identification and Mitigation System (**TRIMS**) is based on DoD 4245.7-M (the transition templates), NAVSO P-6071, and DoD 5000 event-oriented acquisition. TRIMS identifies and ranks a program's high-risk areas and conducts a full

range of risk assessments throughout the acquisition process so corrective action can be initiated before risks develop into problems. It also tracks key project documentation from concept through production including goals, responsible personnel, and next action dates for future activities in the development and acquisition process.

The **BMP Database** draws information from industry, government, and the academic communities to include documented and proven best practices in design, test, production, facilities, management, and logistics. Each practice in the database has been observed and verified by a team of experienced government engineers. All information gathered from BMP surveys is included in the BMP Database.

SpecRite is a performance specification generator based on expert knowledge across the services. This program guides acquisition personnel in creating specifications for their requirements. It is DOS-based, and organized and structured for the build/approval process. SpecRite's knowledge-based guidance and assistance structure is modular, flexible, and can provide output in MIL-STD 961 format and WP 5.1 files.

To access BMPnet via dial-in or on Internet, users need a special modem program. This program is obtained by calling the BMPnet Help Desk at (301) 403-8179 or via the World Wide Web at <http://www.bmpcoe.org>. If you want a personal account to receive e-mail, forward your request to the BMPnet Help Desk.



Appendix E

Best Manufacturing Practices Satellite Centers

There are currently six Best Manufacturing Practices (BMP) satellite centers that provide representation for and awareness of the BMP program to regional industry, government and academic institutions. The centers also promote the use of BMP with regional Manufacturing Technology Centers. Regional manufacturers can take advantage of the BMP satellite centers to help resolve problems, as the centers host informative, one-day regional workshops that focus on specific technical issues.

Center representatives also conduct BMP lectures at regional colleges and universities; maintain lists of experts who are potential survey team members; provide team member training; identify regional experts for inclusion in the BMPnet SIG e-mail; and train regional personnel in the use of BMP resources such as the BMPnet.

The six BMP satellite centers include:

Corona, CA

Chris Matzke

Quality Assurance Engineer
Naval Warfare Assessment Division
Code QA-21, P. O. Box 5000
1456 Mariposa Drive
Corona, CA 91718
(909) 273-4992
fax: (909) 273-5315
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Louisville, KY

Marshall Bramble

BMP Representative
Louisville Site, Crane Division
Naval Surface Warfare Center
5401 Southside Drive
Louisville, KY 40214
(502) 364-5272
fax: (502) 364-5272
internet: mbramble@bmpcoe.org

Oak Ridge, TN

Tammy Graham

BMP Representative
Martin Marietta Energy Systems
P. O. Box 2009, Bldg. 9737
MS 8091
Oak Ridge, TN
(615) 576-5532
fax: (615) 574-2000
internet: tgraham@bmpcoe.org

Rockford, IL

Dean Zaumseil

Mid-Western Representative
3301 North Mulford Road
Rockford, IL 61114
(815) 654-5530
fax: (815) 654-4459
internet: adme3dz@rvcux1.rvc.cc.il.us

Vallejo, CA

Jack Tamargo

West Coast Representative
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York, PA

Sherrie Snyder

Manager, Information Services
MANTEC, Inc.
P. O. Box 5046
York, PA 17405
(717) 843-5054
fax: (717) 854-0087
internet: snyderss@mantec.org

Appendix F

Navy Manufacturing Technology Centers of Excellence

The Navy Manufacturing Sciences and Technology Program established the following Centers of Excellence (COEs) to provide focal points for the development and technology transfer of new manufacturing processes and equipment in a cooperative environment with industry, academia, and Navy centers and laboratories. These COEs are consortium-structured for industry, academia, and government involvement in developing and implementing technologies. Each COE has a designated point of contact listed below with the individual COE information.

Best Manufacturing Practices Center of Excellence

The Best Manufacturing Practices Center of Excellence (BMPCOE) provides a national resource to identify and promote exemplary manufacturing and business practices and to disseminate this information to the U.S. Industrial Base. The BMPCOE was established by the Navy's BMP program, Department of Commerce's National Institute of Standards and Technology, and the University of Maryland at College Park, Maryland. The BMPCOE improves the use of existing technology, promotes the introduction of improved technologies, and provides non-competitive means to address common problems, and has become a significant factor in countering foreign competition.

Point of Contact:

Mr. Ernie Renner

Best Manufacturing Practices Center of Excellence

4321 Hartwick Road

Suite 400

College Park, MD 20740

(301) 403-8100

FAX: (301) 403-8180

ernie@bmpcoe.org

Center of Excellence for Composites Manufacturing Technology

The Center of Excellence for Composites Manufacturing Technology (CECMT) provides a national resource for the development and dissemination of composites manufacturing technology to defense contractors and subcontractors. The CECMT is managed by the GreatLakes Composites Consortium and represents a collaborative effort among industry, academia, and government to develop, evaluate, demonstrate, and test composites manufacturing technologies. The technical work is problem-driven to reflect current and future Navy needs in the composites industrial community.

Point of Contact:

Dr. Roger Fountain

Center of Excellence for Composites Manufacturing Technology

103 Trade Zone Drive

Suite 26C

West Columbia, SC 29170

(803) 822-3705

FAX: (803) 822-3730

frglcc@aol.com

Electronics Manufacturing Productivity Facility

The Electronics Manufacturing Productivity Facility (EMPF) identifies, develops, and transfers innovative electronics manufacturing processes to domestic firms in support of the manufacture of affordable military systems. The EMPF operates as a consortium comprised of industry, university, and government participants, led by the American Competitiveness Institute under a CRADA with the Navy.

Point of Contact:

Mr. Alan Criswell

Electronics Manufacturing Productivity Facility

Plymouth Executive Campus

Bldg 630, Suite 100

630 West Germantown Pike

Plymouth Meeting, PA 19462

(610) 832-8800

FAX: (610) 832-8810

<http://www.engriupui.edu/empf/>

National Center for Excellence in Metalworking Technology

The National Center for Excellence in Metalworking Technology (NCEMT) provides a national center for the development, dissemination, and implementation of advanced technologies for metalworking products and processes. The NCEMT, operated by Concurrent Technologies Corporation, helps the Navy and defense contractors improve manufacturing productivity and part reliability through development, deployment, training, and education for advanced metalworking technologies.

Point of Contact:
Mr. Richard Henry
National Center for Excellence in Metalworking
Technology
1450 Scalp Avenue
Johnstown, PA 15904-3374
(814) 269-2532
FAX: (814) 269-2799
henry@ctc.com

Navy Joining Center

The Navy Joining Center (NJC) is operated by the Edison Welding Institute and provides a national resource for the development of materials joining expertise and the deployment of emerging manufacturing technologies to Navy contractors, subcontractors, and other activities. The NJC works with the Navy to determine and evaluate joining technology requirements and conduct technology development and deployment projects to address these issues.

Point of Contact:
Mr. David P. Edmonds
Navy Joining Center
1100 Kinnear Road
Columbus, OH 43212-1161
(614) 487-5825
FAX: (614) 486-9528
dave_edmonds@ewi.org

Energetics Manufacturing Technology Center

The Energetics Manufacturing Technology Center (EMTC) addresses unique manufacturing processes and problems of the energetics industrial base to ensure the availability of affordable, quality energetics. The focus of the EMTC is on process technology with a goal of reducing manufacturing costs while improving product quality and reliability. The COE also maintains a goal of development and implementation of environmentally benign energetics manufacturing processes.

Point of Contact:
Mr. John Brough
Energetics Manufacturing Technology Center
Indian Head Division
Naval Surface Warfare Center
Indian Head, MD 20640-5035
(301) 743-4417
DSN: 354-4417
FAX: (301) 743-4187
mt@command.nosih.sea06.navy.mil

Manufacturing Science and Advanced Materials Processing Institute

The Manufacturing Science and Advanced Materials Processing Institute (MS&MPI) is comprised of three centers including the National Center for Advanced Drivetrain Technologies (NCADT), The Surface Engineering Manufacturing Technology Center (SEMTC), and the Laser Applications Research Center (LaserARC). These centers are located at The Pennsylvania State University's Applied Research Laboratory. Each center is highlighted below.

Point of Contact for MS&MPI:
Mr. Dennis Herbert
Manufacturing Science and Advanced Materials
Processing Institute
ARL Penn State
P.O. Box 30
State College, PA 11804-0030
(814) 865-8205
FAX: (814) 863-0673
dbh5@psu.edu

- **National Center for Advanced Drivetrain Technologies**
The NCADT supports DOD by strengthening, revitalizing, and enhancing the technological capabilities of the U.S. gear and transmission industry. It provides a site for neutral testing to verify accuracy and performance of gear and transmission components.

Point of Contact for NCADT:
Dr. Suren Rao
National Center for Advanced Drivetrain
Technologies
ARL Penn State
P.O. Box 30
State College, PA 16804-0030
(814) 865-3537
FAX: (814) 863-1183
http://www.arl.psu.edu/drivetrain_center.html/

- **Surface Engineering Manufacturing Technology Center**

The SEMTC enables technology development in surface engineering—the systematic and rational modification of material surfaces to provide desirable material characteristics and performance. This can be implemented for complex optical, electrical, chemical, and mechanical functions or products that affect the cost, operation, maintainability, and reliability of weapon systems.

Point of Contact for SEMTC:
Surface Engineering Manufacturing Technology Center
Dr. Maurice F. Amateau
SEMTC/Surface Engineering Center
P.O. Box 30
State College, PA 16804-0030
(814) 863-4214
FAX: (814) 863-0006
http://www.arl.psu.edu/divisions/arl_org.html

- **Laser Applications Research Center**

The LaserARC is established to expand the technical capabilities of DOD by providing access to high-power industrial lasers for advanced material processing applications. LaserARC offers basic and applied research in laser-material interaction, process development, sensor technologies, and corresponding demonstrations of developed applications.

Point of Contact for LaserARC:
Mr. Paul Denney
Laser Center
ARL Penn State
P.O. Box 30
State College, PA 16804-0030
(814) 865-2934
FAX: (814) 863-1183
http://www.arl.psu.edu/divisions/arl_org.html

Gulf Coast Region Maritime Technology Center

The Gulf Coast Region Maritime Technology Center (GCRMTC) is located at the University of New Orleans and will focus primarily on product developments in support of the U.S. shipbuilding industry. A sister site at Lamar University in Orange, Texas will focus on process improvements.

Point of Contact:
Dr. John Crisp
Gulf Coast Region Maritime Technology Center
University of New Orleans
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New Orleans, LA 70148
(504) 286-3871
FAX: (504) 286-3898